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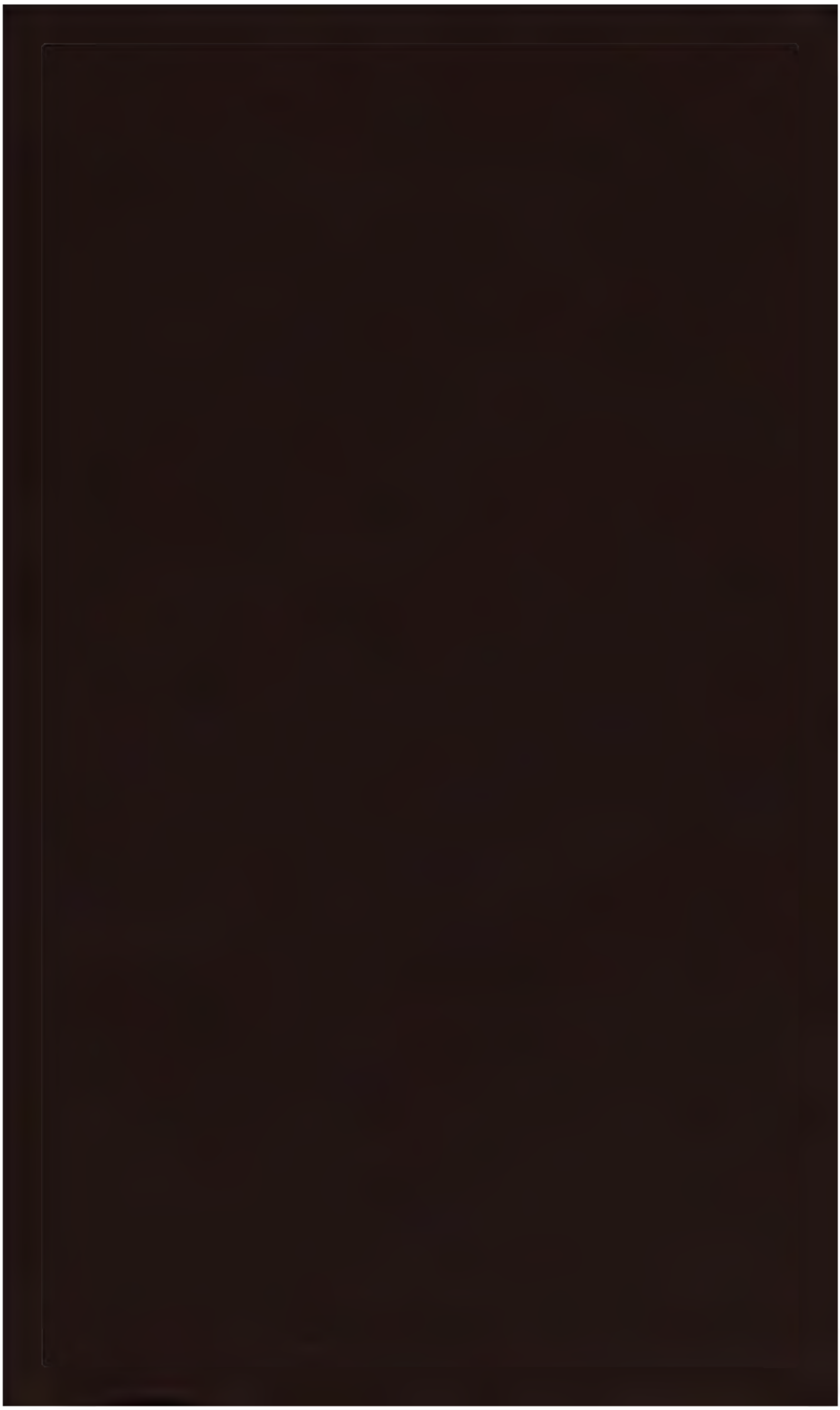

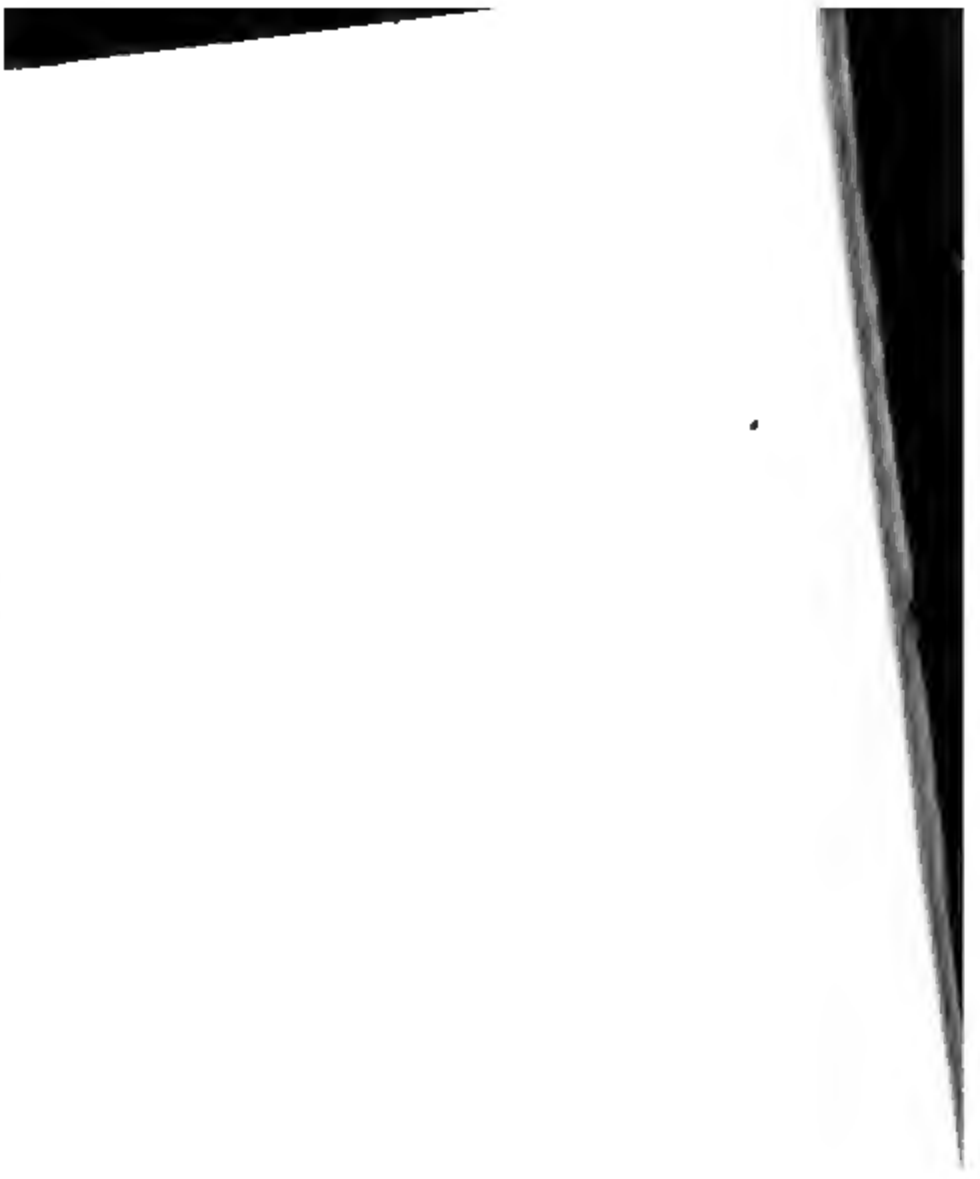

H. M. Menler, Jr.

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PROBLEMS

OF

LIFE AND MIND.

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PROBLEMS

OF

LIFE AND MIND

BY

GEORGE HENRY LEWES

First Series

THE FOUNDATIONS OF A CREED

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PROBLEM II.

THE PRINCIPLES OF CERTITUDE.

"Alles Philosophiren geht aus von einer dem Menschen inwohnenden Sehnsucht nach einer Erkenntniss, die er die Erkenntniss des Wahren nennt, ohne sich selbst genügend erklären zu können, was ihm dieses über alles bedeutende Wort eigentlich bedeute."

JACOBI.

"Τὸ γὰρ αὐτὸ ἅμα ὑπάρχειν τε καὶ μὴ ὑπάρχειν ἀδύνατον τῷ αὐτῷ καὶ κατὰ τὸ αὐτό. . . . Αὕτη δὴ πασῶν ἐστὶ βεβαιοτάτη τῶν ἀρχῶν."

ARISTOTLE, *Metaph.* iii. 3.

"Sicut lux se ipsam et tenebras manifestat, sic veritas norma sui et falsa est."

SPINOZA.

"Eine enorme Demuth des Geistes, auf das Erkennen nichts zu halten!"

HEGEL.

THE PRINCIPLES OF CERTITUDE.

CHAPTER I.

THE PROBLEM STATED.

1. THE Universe is mystic to man, and must ever remain so; for he cannot transcend the limits of his Consciousness, his knowledge being only knowledge of its changes. Minds of deep emotive sensibility are apt to feel pained, even exasperated, by scientific explanations which decline the imaginary aid of some incomprehensible outlying agency not expressible in terms of experience. They dread lest research should dissipate their awe by removing the darkness, and thus rob Nature of that mystery which deepens as they gaze. They are only reconciled to the procedures of research on learning what Explanation truly is, namely, the decomposition of the facts of Experience into their components, and the assigning to each its place; so that what is called accounting for a phenomenon is the pictured, or symbolised, representation of what *is* not, but what under other conditions *might be*, a presentation to Feeling. *Science is seeing with other eyes.* It enables us to foresee

results which are not obvious to the inferences of ordinary perception—nay, are often in direct contradiction to such inferences (as when the earth is mentally seen to be revolving round the sun). But this prevision is strictly accordant with all the conditions of vision. If the curve seems to get straighter the more it is magnified, this is no longer so when all other things, the vision included, are magnified in the same ratio. Whenever Reason passes beyond the boundaries of Sense, it is only by an extension or magnification of the data of Sense.

2. We observe phenomena, and we explain them. This means that we have actual feelings, and analyse them into possible feelings; as we grasp things, and take them to pieces to see what they are composed of. The observation, and the judgment which follows observation in an action of some kind, belong to the animal side of our nature: with this Logic of Feeling the animal is content. Not so the man. He desires to explain what he sees; to understand what he feels. The Logic of Feeling is in him supplemented and magnified by the Logic of Signs, which has two cardinal procedures—*Naming* and *Measuring*. By means of these two kinds of classification—the qualitative and the quantitative—he registers his experiences, and those of his contemporaries, in signs, which represent his intellectual wealth as moneys represent his physical wealth. All his names and quantities were originally feelings; he can therefore employ them in lieu of feelings, under certain conditions, as he can exchange coins for goods, under similar conditions—namely, that the coins have the exchangeable values which he assigns to them.

3. Explanation, then, is analysis, real or ideal, sensible or extra-sensible. It takes the object, or the feeling, to pieces; and is a perfect analysis when the pieces that are obtained can be put together again, and form the original whole. The mechanism of a watch is very complex, but it is perfectly explained when the springs, wheels, cogs, escapements, &c., are exhibited in their reciprocal relations. Having taken it to pieces, we can put it together again; and this synthesis is shown to be perfect by the watch "going" as it "went" before. The mechanism of an organism is more complex; and our analysis of it is so imperfect, that we cannot put it together again—except ideally. Why? Not — as is often said — because the one mechanism is more mysterious than the other, a mystery which arises from the presence of a supra-sensible agent; but because we do not really know what *are* the reciprocal relations of all the parts. If, in attempting to reconstruct the watch, we omit a single wheel, or even a pin, or place one small part in a wrong position, the watch will not "go;" nor will the organism live, if we omit or misplace a single factor.

"Hat die Theile in ihrer Hand,
Fehlt, leider! nur das geistige Band." *

By a similar procedure the mechanism of the great horologe of the heavens is explained when the mathematical relations of the planetary masses are analysed, and the synthesis is effected by comparison of these conceptions with the observed facts. We cannot analyse or reconstruct the heavens, except in symbols; but if these symbols accurately represent observations, they

* Faust.

are their *rational equivalents* (as coins are the social equivalents of goods), and in reconstructing them we are rationally reconstructing the heavens from our analysis. The law of inverse squares—that potent symbol—could never have been an observation; but it is an ideal construction from very precise observations, and is found to express them with sufficient accuracy to be accepted as their rational equivalent.

4. Explanation, then, is an unfolding or rendering explicit (*explicatio*) of elements that are implicit in the phenomenon explained. Phenomena have two aspects, statical and dynamical: they are products and processes, according to our mode of viewing them—*i.e.*, 1°, when we try to ascertain what a thing is, and to describe it; or 2°, when we try to ascertain how it came to be what it is, and try to reconstruct its history. Much confusion arises in philosophical debate from not clearly distinguishing these points of view, so that questions of Anatomy are mingled with questions of Morphology, questions of Psychology with questions of Psychogeny, and Descriptions with Evolutions. When a geometer explains the properties of a figure, he unfolds to the pupil's eye what those properties are, he does not speak a word as to how they came there; when a chemist explains the properties of an acid, he simply describes its relations to other bodies, and is silent respecting its genesis, which is taken for granted; when a biologist explains the structure and properties of an organ, he makes no reference to its stages of evolution. Each of these explanations views the products, describes the objects in their statical aspect—*i.e.*, as ready to act. But each may give rise to the other kind of

explanation, which renders explicit the genesis, and describes the processes; pointing out what are the *momenta*, what are the implied conditions which must co-operate in such products. Now as each of these *momenta* was itself a product, and had its process, the question of genesis may lead by a continual regress, from antecedent to antecedent *ad infinitum*. To obviate the futility of such endless retrogression, Science is compelled to accept certain limits as final; and these limits may be arbitrary, when they suffice for the immediate purpose of the research — (conventional ultimates) — or necessary, when they abut on some deadwall of ignorance, which may one day be removed, or on some ultimate of Feeling, which can never be passed beyond.

5. Every explanation is thus a classification of facts by means of ideas which originally were observations; and is a true classification in proportion to the extent of the observations, and the accuracy with which the ideas represent them. An explanation, to be valid, must be *expressed in terms of phenomena already observed*—that is, either drawn directly from observation, or indirectly from a comparison of inferences with sensations. In each of its terms there must be represented a *sensible experience*, or its *rational equivalent*. Every explanation is illusory which is more than a classification of observations, direct and indirect. The proof or validity of an explanation is given by the comparison of the ideal synthesis with the real synthesis, when prevision is compared with vision, inference with fact.

But the very best explanation is imperfect if we refuse to restrict ourselves within the limits of scien-

tific finality, and demand a cause of the cause, an origin of the origin. It is in this sense that mystery for ever accompanies our search, a shadow which recedes, but never lessens. Unexplored remainders lie beyond every limit. Our wisdom lies in recognising them as unexplored, and not allowing an immediate purpose to be disturbed by them. When the chemist has analysed water into its constituent gases, and shown us that the precise amount of molecular motion which was necessary to decompose the water into these gases has only to be withdrawn from them in order to restore the water to its original state—when he has thus proved the completeness of his analysis by reconstructing the water—he has given us a relatively perfect explanation. Nor is this perfection lessened by its relativity. Each gas may in turn present a fresh problem, and their union may be viewed as a special case of some wider law. But the explanation of the composition of water is complete within the limits assigned.

6. To know what Explanation can effect, and how this is to be effected, is of the highest importance. It cannot pretend to be more than a description of our experiences in the form of images and symbols—each of which contains elements which point to what is unexplored and inexpressible. The reality is the felt. This we resolve, ideally, into its elements. Science, although constructed with the purpose of guiding Action, and therefore indirectly dealing with Reality, never directly operates on Reals, but on Abstractions, as shown in our first volume. Abstractions are raised from concretes, and represent them symbolically. Thus the mathematician explains only the mathematical universe; the physicist and chemist

is excluded from a Philosophy which systematises Experience; excluded because it is not part and parcel of the registrations of Experience. If, as I hold, Thought is the algebra of which Feeling is the arithmetic,—if conceptions are but the symbols of perceptions, and have real values only in feelings, it follows that no thoughts can represent the order in Nature, except in so far as they represent the order in Experience. By thus giving precision to the term, and enlarging it so as to include the Extra-sensible data beside the Sensible, and Intuition beside Sensation, and further to admit among the elements of individual Experience the modification due to ancestral experiences, and the influences of the Social Medium (whence arise the vast extensions of Reason through the employment of verbal symbols), I have shown that all the phenomena of Cognition are empirical; and *per contra*, that every metempirical conception is a symbol to which no real value can be assigned, consequently cannot enter into a system of knowledge representing Reality.

But although I venture to consider the analysis there given to be exhaustive, especially if the chapter on the part played by Sentiment in Philosophy be taken into account, I am too well aware of the influence of old opinions,—and of the difficulty of relinquishing the traditional conception of Reason (as something more than feeling operating on symbols)—not to be prepared for open dissent on the part of important thinkers. When the reader has had laid before him the analysis of our mental mechanism, I shall hope to gain more general acceptance of this fundamental position; but as that analysis will come in a subsequent volume, I must be content to ask that, for the

impossible is the metempirical explanation, not the analytical—it is the seeking of a light behind the light, a ground beneath the ground: *that* is, and must be, an eternal mystery.

7. But if Science is ideal construction, and is formed out of Abstractions, none of its general statements being true of Reals, the question arises, Are there any principles of Certitude,—or is all research vain? It is this question to which we now address ourselves.

We shall assume the reader's assent to the position that Knowledge is the systematisation of Experience, and therefore limited in its range to the Sensible and Extra-sensible; excluding altogether whatever is Supra-sensible. It is a position, indeed, vehemently attacked by all metempirical thinkers; but I can only refer to what was said in the preceding Problem, when showing that the arguments urged by metempiricists rest either on unwarrantable assumptions, or on a very improperly restricted interpretation of the term Experience. Whatever may have been the more or less indefinite opinions held by certain advocates of the empirical philosophy, which may justify their opponents in supposing that Experience only means Sensation, and that it "excludes every feeling which cannot ultimately be associated with an impression on the senses" (here obviously indicating the Five Senses), no attentive reader of the present work will recognise this as the Experience to which Philosophy is limited. We do indeed limit it to the *registrations of feeling*; and we say that any idea which is not the reproduction of a feeling, or any conception which does not represent perceptions in their sensible order, but perverts that order, or introduces supra-sensible elements,

is excluded from a Philosophy which systematises Experience; excluded because it is not part and parcel of the registrations of Experience. If, as I hold, Thought is the algebra of which Feeling is the arithmetic,—if conceptions are but the symbols of perceptions, and have real values only in feelings, it follows that no thoughts can represent the order in Nature, except in so far as they represent the order in Experience. By thus giving precision to the term, and enlarging it so as to include the Extra-sensible data beside the Sensible, and Intuition beside Sensation, and further to admit among the elements of individual Experience the modification due to ancestral experiences, and the influences of the Social Medium (whence arise the vast extensions of Reason through the employment of verbal symbols), I have shown that all the phenomena of Cognition are empirical; and *per contra*, that every metempirical conception is a symbol to which no real value can be assigned, consequently cannot enter into a system of knowledge representing Reality.

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present, the position be taken as my postulate. It is necessary to the whole system here expounded; and any one who refuses to grant it, at least provisionally, need not trouble himself to read further.

OUR COSMOS.

8. Existence—that is to say, the only Existence contemplated by us—is objective Experience: it is the external aspect of Feeling. Nothing can have Reality for us until it enters within the circle of Feeling, either directly through Perception, or indirectly through Intuition. Conception is the symbolical representation of such real presentation.

Our Cosmos, the phenomenal World, is the theatre in which the drama of life is played. However the actors may trouble themselves with what goes on "behind the scenes," they have no serious interest in what goes on (if anything goes on) behind the walls of the theatre. They do, indeed, suppose that much is going on there; but if they think of it at all, they must liken it to the familiar events of their own drama, for they have no other points of comparison. Momently aware of fresh influxes from beyond the circle of our personal feelings, beyond even the experiences of our ancestors and contemporaries, we postulate an indefinite Unknown beyond the circle of the Known: it is an ocean surrounding our island, and from the depths of this ocean rise up other islands, more or less resembling our own.

9. Our world arises in Consciousness. This conception, which is the conquest of modern speculation, must not be confounded with the conception of Idealism, which abolishes the reality of an external world,

and transforms it into the phantasmal projection of our internal changes; so that when we see a tree waving in the wind, or see a tower shattered by a cannon-ball, all that *really* passes is supposed to be the image of a tree waving, or the image of a tower falling beneath the imaged stroke of a pictured cannon-ball. On the contrary, the conception here brought forward insists upon the external Real as the complementary factor of the internal feeling; but, inasmuch as it is a factor, it cannot be *separated*, though it can be *distinguished*, from the product. There cannot be an object without a correlative subject; there cannot be a quality without a correlative feeling; and *vice versa*. The identity of object and subject may be illustrated as that of light and sight—which popular language with happy ambiguity expresses in the word sensation, meaning both the act of feeling and the felt. We cannot see without light, for the light is the seen; nor can the vibrations of the ether (supposed to be the objective factor in light) be brought into certain relations with the optic apparatus without being thereby transformed into light: the vibrations, by combination with certain neural units, yield this product. The combination is necessary for the result. Detach one of the factors—objective or subjective—and the product is impossible. The familiar fact that we cannot see in the dark, or with closed eyes,—that in the dark no straining of the eye, or with closed eyes no effort of the will, can produce this luminous product, early led men to discriminate between the agents and the action; and this led to a distinction between the subject and the object, which by a natural ten-

dency soon grew into a belief in their separation. Generalising this, and similar distinctions, popular thought assumes that the sensible objects are already present, in time and space, and that we have only to open our eyes and recognise them; so that, on the one hand, there is the world of forms, colours, movements; on the other, the Mind with its faculties which grasps these, or its "mirror" which reflects their images.

10. Modern philosophy has rectified this notion. The forms, colours, movements, &c., are all necessarily modes of Feeling. The object is always object-subject; the thing is always the thing felt. We may distinguish the aspects by marks, we cannot isolate the factors. The eye learns to discriminate colours, and shades of colour, where at first there was only a vague blur of feeling. The flower we see is not seen by the infant; what the infant sees is what he has learned to see; slowly the blur of feeling differentiates—and the stem, leaves, petals, pistils, &c., once observed, are ever after observable: they then exist for the observer. Did they not exist before? Certainly they did—but only for some observant mind, not for the infant. Objective factors (not otherwise to be specified) existed as permanent possibilities, which might become Reals when combined with subjective factors. In strict correspondence with the degrees of subjective distinction is the objective differentiation. Obviously, if we suppose the existence of external factors, we must admit that they operated from the first in determining the internal feeling—they were elements in the blurred sensation before they were distinguished in the definite perception.

Centuries before men spoke of blue, thought of it, or distinguished it *as* blue, they must have felt it when they looked at the sky, or the sea; just as a cat, though unable to count six, will feel that all her kittens are not there if she sees only five. But even for this blurred sensation there must be a corresponding object; and just as without an object there can be no sensation, nor without a subject an object, so likewise without subjective discrimination there can be no objective differentiation. The world arises in consciousness — not as the product of the subject only, but as the product of object and subject. And just as what we call the objective world, with its manifold varieties, is the differentiation of Existence due to Feeling and Thought, so what we call the subjective world, with its manifold varieties of perception and conception, is the differentiation of Feeling, due to the action and reaction of the Organism and its Medium. With each stage in evolution of the sensitive organism arises a corresponding differentiation in the Cosmos. Reflective Consciousness transforms feelings into things, which in turn react on Feeling, and differentiate it; so that the thing we now perceive, although originally a blurred sensation which had to be differentiated and rendered precise by the grouping and discrimination of sensations, is so to speak the nucleus around which other feelings group themselves, and thus the thing becomes a centre of crystallization.' And what is once acquired may be transmitted. The child of European parents inherits an organism more apt to grasp the results of culture; and he is born into a society where lie ready to hand the long results of patient toil and fiery invention, not only in

the instruments and appliances by which the forces of Nature may be turned into servants, but also in the Language and Knowledge by which the forces of Nature may be understood. The world grows as we grow; and we grow with the growth of the world. Nothing exists, for us, but what is felt. We are the centres *to* which the intelligible universe converges, *from* which it radiates.

11. Existence, therefore, is objective Experience, and Experience is subjective Existence. A thing exists for us only in its knowable relations—which may be sensible, or extra-sensible; and a thing is real or ideal according as it is presented in Feeling, or represented in symbols. Goethe truly says—

"Im Innern ist ein Universum auch"—

"We carry a universe within us;" by which phrase we may interpret the Protagorean *dictum*—"Man is the measure of all things."

THE TWOFOLD ASPECT.

12. The human point of view is in all respects absolute and final for us. The basis and content of all Experience is Feeling. Reflecting on this, and analysing Feeling into its components, we find it always presenting a Twofold Aspect, real and ideal, actual and virtual, particular and general. Existence is real when *felt* or *perceived*; ideal when *imaged* (*i.e.*, when a feeling is reproduced by an internal stimulus, and not by an external stimulus) or *conceived* (*i.e.*, when feelings are represented in symbols). By the Real is meant whatever is given in Feeling; by the Ideal is meant what is virtually given, when the pro-

cess of Inference anticipates and intuites what *will* be or *would* be Feeling under the immediate stimulus of the object. Any inference which is not the reproduction of feelings formerly produced is erroneous; any inference which cannot be realised in feelings is illusory. All metempirical inferences are of this latter class.

13. We have not only Feeling, but the Logic of Feeling, or that primary operation of its Relativity by which differences are distinguished from resemblances, as the necessary consequence of that process of neural Grouping, which is the physiological condition of feeling—or of that process of Change in the relations, which is the psychological condition of feeling. That is to say, unless neural units are grouped, and these groups coalesce into other groups, there is no Sensation, no Perception, no Conception. Unless there be a change in the relations, there can be no Consciousness. Unless there be movement, there is no life, vital or psychical: immobility is death. Change, movement, grouping—involve two terms of a relation: the point of departure and the point of arrival. When a present feeling changes, *i.e.*, passes into another, the *movement is an incorporation of the two.* Hence the two are correlative. The Twofold Aspect is not of separation but of distinction.

14. Difference has its correlative in Resemblance: neither is possible without reflecting the other. If all our feelings resembled each other indistinguishably, they would be one feeling; nor could the sense of Difference arise without a related Resemblance from which it was discerned. We cannot conceive an *individual* without in the same act implying a *class* to

which it belongs, and a larger class from which it is distinguished. The part exists only as part of a whole; the whole exists only as a whole of its parts. We can, indeed, have a particular perception or conception without any obtrusion in consciousness of the class to which it belongs, for this class is only apparent in reflection. But although in the one aspect every feeling is particular and synthetic,—being a group, an integral,—it is nevertheless a synthesis of elements which analysis discloses as involving correlatives. To be felt, or known, as a distinct group, it must reflect its correlative from which it is distinguished. Succession could not be felt unless coexistence were also felt. Creation could not be conceived unless a creator was conceived; nor a creator without a creation; an effect without a cause; a finite without an infinite; an object without a subject.

15. This necessary movement of Thought corresponds with the flow of Things, and has its condition in that fundamental Relativity which is disguised from us by our tendency to mistake abstractions for realities, and logical distinctions for real separations. Hence it is that philosophers, having distinguished the aspects, and taken each in its abstraction as if it were not the one term of a relation only, but an entity *per se*—having thus distinguished, and then separated, object from subject, cause from effect, creator from creation, puzzle themselves with the problem, What is the connecting link between these opposites? What is the bridge over which object passes into subject, and cause into effect? There is no bridge. The object is object-subject, the cause is the effect, the effect is the *causatum* (see PROBLEM V. chap. ii.), the

natura naturans is *natura naturata*, viewed under opposite aspects. The universe to us is the universe in Feeling, and all its varieties are but varieties of Feeling. We separate these into object and subject, because we are forced to do so by the law of Relativity. With the feeling of difference or *otherness* arises the judgment of *not this*, which in turn evolves the distinction of Self and Notself. These two aspects are abstractions; in Feeling they emerge simultaneously as correlations. I can only be conscious of Self—however dimly—by detaching one group of feelings from another group, assigning a subjective unity of continuity to the one, and an objective unity to the other. This otherness is generalised as Notself. All the feelings which pass into each other by continuous movement are detached from those which are not thus interdependent. The separating intellect detaches the Cosmos from the universal Existence, and then detaches Consciousness from the Cosmos, as it detaches a particular from an universal. The identifying intellect reverses this procedure, and sees in the primary fact of Feeling an implicit unity of the two Aspects which are explicit in Abstraction.

16. Nor does the process end here. The separation of one aspect from the other is followed by a splitting of each into two. Thus Self, the generalised abstraction of continuous Feeling, is detached from its concrete discontinuous states, and we speak of Self *and* its states as two separable terms. In like manner the Notself, or generalised abstraction of continuous Existence, is detached from its particular manifestations, and is spoken of as Noumenon *and* its phenomena. No doubt the Subject is logically

other than its Predicates, Self other than its States; but this otherness is logical not real, analytical not synthetical. If we analyse a concrete thing into its qualities which are viewed in abstraction—*i.e.*, not as the Relations constituting this particular group, but as Relations similar to what we have found constituting other groups—this logical procedure may be immensely advantageous, but it must not be accepted as more than an artifice.

17. In like manner when we distinguish a given feeling into its two aspects, and treat these correlatives as abstractions suitable to our logical procedure, we must not be misled into the belief that our artifice has its parallel in Reality. This, however, is what philosophers are repeatedly doing. Because all our conceptions are twofold, and because one correlative reflects the other, they come to assign a reality to negative conceptions—nay, in some cases to assign them a higher validity than the positive. Thus it is with the popular distinction between a Thing and its Relations,—between noumena, or things in themselves, and phenomena, or things in relation. Given the world of Feeling, they first distinguish it from a world of Unfelt Existence, and then assign to this correlative abstraction the "deeper reality of a world behind the field of phenomena;" not aware that this abstraction only represents the negation of their positive experience, and cannot be interpreted into any terms of Feeling, except that of the inevitable *otherness*, which is the condition of any one feeling. Reflection on the nature of Thought discloses it to be in movement. A thought always is related to some other thought, is always followed by some other:

what that other will be depends upon the psychical conditions, themselves the product of the mind's history. Reflection on the nature of Things also discloses this necessary relativity: one thing is directly related to some other; and *what* that other is depends upon the conditions, the product of the world's history. These two modes of existence are on different planes, and the problem is to make the planes parallel, so that the movement of Thought shall always accurately adjust itself to the movement of things. This parallelism may seem to be a necessary consequence of what was said in § 10 respecting the transformation of feelings into things. But it is not so, and on two grounds: Firstly, because thoughts are symbols only, and are variously interpreted; secondly, because the thoughts of an individual mind, having a life and movement of their own,* do not always follow in the track which Things have left, or will leave in the minds of others; and the true objective aspect is always understood to be that which is presentable to all minds.

18. While it is true that correlatives imply each other, it is not true that all correlatives imply Reals. Being and Non-Being, as abstractions, are correlative: the one implies the other. Essence and Manifestation are likewise correlative. But if we compare these with such correlatives as Beauty and Ugliness, Good and Evil, or Light and Darkness, we are made aware of a broad distinction between the correlatives which are logical, and the correlatives which are real: in other words, between contradictions and contraries. Non-Being and Essence are

* See PROBLEM III. § 3.

negations; Ugliness, Evil, and Darkness, are positives, which have their objective grounds: they have their gradations, whereas Negations are not only without gradation, but are without any sensible or ideal specification—between Non-Being, Pure Space, and the *Ding an sich*, there is no intelligible difference, except such as each borrows from its correlative; whereas, between Ugliness and Evil and Darkness there are differences as manifold and determinate as between Flowers, Crystals, and Poems. That is to say, the one class of correlatives has its ground in the logical condition of Difference; the other class has its ground in the real condition of Relativity in things. Both correlatives, separately viewed, are abstractions; but the one abstraction represents no definite feelings, the other does.

19. The Twofold Aspect is therefore the alternation of abstractions. All Feeling and all Thought being necessarily relative, the relation has two terms, one of which cannot be dominant in consciousness without throwing the other into obscurity, but neither of them can be thought without calling up the other. When we draw diagrams on paper, it is on these diagrams and not on the paper that attention is concentrated, they are viewed in abstraction from the paper, although the paper is on reflection seen to be their necessary ground; or we may alternate from the diagrams to the paper. So in the field of vision—optical or psychological—various objects are distinguished *from each other* and *from the general field*; but all these are abstractions which Reflection restores to their real unity.

20. What is the purpose of Philosophy? What is the part played by Knowledge? Its highest no less than its lowest aim is guidance in action. Feeling inevitably issues in action: but is limited to the direct relations, and needs the guidance of a vision of relations that are not directly felt. Knowledge is simply virtual Feeling, the stored-up accumulations of previous experiences, our own and those of others: it is a vision of the unapparent relations which will be apparent when the objects are presented to Sense. Hence the imperious desire to find out how the thing *came to be* what it is, and what it *will be* under other circumstances. Our sensible experiences grow into knowledge by a twofold process of grouping and classification; Feeling is added to feeling, quality to quality, each group enlarging with every fresh experience; and this process of incorporation henceforward causes any one of the feelings to revive the others, so that the sight will revive the taste or smell, and the name will revive the image. Nay more, the process also causes any one of these feelings to be detached from those to which originally it cohered, and to enter into some new group, thus linking the two groups together, and revealing them as *like* one another. Every perception is felt to be at once like, and unlike others. It is a cluster of feelings and images of past feelings.

21. Note further, that in consequence of this very process of incorporation, a concrete individual object is only known through qualities which, as qualities, are abstract and general. This iron bar is perceived by me, but my perception is due to a previous transformation of feelings into an object (§ 10); and now

that it stands before me as a thing, how do I know it to be an iron bar? My cognition—as distinguished from my perception—is a *re*cognition, and transports the object out of the sphere of individual feeling into the sphere of general thought. I *re*cognise it as a group of already known qualities, each of which has been many times felt by me in other combinations. It is seen to be extended and coloured; these actual feelings revive the ideas of solidity, coldness, fusibility, &c., which once were feelings, and will again be feelings, under requisite conditions. The more feelings I have experienced in connection with this and similar groups, the more qualities I assign to the groups, the greater is my knowledge of the iron bar; I can only *re*cognise these qualities because I have formerly cognised them or similar feelings. All these experiences associated with a visible sign, or condensed in a verbal symbol, enable me to employ them as Knowledge—that is, to guide my actions. I rely on my virtual feeling of the unapparent relations as if it were actual feeling of reals; without proceeding to verify my inferences, without testing the assumed hardness, weight, fusibility, &c., of the *re*cognised group, I proceed to employ the iron bar for my purposes, confident that the unapparent qualities will appear under appropriate conditions.

But now mark this difference: the sensible inferences following upon this visible sign may prove to be wholly treacherous, since a piece of painted wood, or of some different metal, may excite similar visual feelings; and it is only by reducing inferences to sensation, placing the object in those conditions which will manifest the unapparent qualities, that I

can be safe in employing the bar as an iron bar. Whereas rational inferences from the verbal symbol "iron bar" are absolutely certain. The judgment of Perception: "This is an iron bar, and may therefore be employed in all the tried uses of iron bars," is possibly false; the judgment of Reason, which simply unfolds the experiences condensed in the verbal symbol, and only *evolves* by way of inference what the conception "iron bar" *involves*, must be true. The sensible inference is nevertheless occupied with reals, and the rational inference with ideas; why the truth of the one should be contingent, and the truth of the other necessary, is an interesting question—the answer to which must, however, be postponed awhile.

22. Things are groups of Relations—conjunctures of events. Take a stone, for instance, and ask, What is it? You can only answer by describing its properties, qualities, history. Floating particles of mud, washed away by the river from its banks, were carried into the sea, and slowly sank down to rest upon the sea-bed; there these particles were *cemented* into masses by silica or iron oxide, the refuse of igneous and metamorphic rocks, and *pressed* into rock by the weight of the superincumbent sea and sand. After it had been thus made into rock, and raised above the sea, it was once more dashed off as a fragment by the beating waves, rounded by water, pressed and knocked into many shapes; until it became what we see it now, the result of myriads of impressed forces. In saying Things are only groups of Relations, we do but follow the logicians who say that Things are the subjects of predicates. Noting, by way of anticipating a

possible difficulty, that each Relation involves two related terms—and always an object and subject—we may add that while a thing can only be *felt* by its action on us, its relation to us, it can only be *described* (that is, pictured to another mind) by a series of abstract expressions, each naming a quality or property which subjectively is a feeling; and it can only be *known*, recognised, in the same way. This distinction must be borne in mind. It seems not to have been apprehended by Hegel and others, who, seizing on the fact that all qualities when *named*, and isolated as abstractions, are necessarily general, concluded that it is by abstractions that the concrete thing is produced, constituted. This, however, is not the genesis of Thought, nor the genesis of Things. Things are abstractions when they stand for subjects, *substrata*, and not for groups of predicates, qualities. Each Thing is an ideal creation, abstracted from a series of particular feelings; or else it is one of these particular qualities, named and made to stand for the whole group. Thus when we *name* the Day, it is only as a sign of "brightness;" when the Moon, it is only as a sign of a "measurer;" when a River, it is only as a sign of "running;" and so on.

23. Our description, or cognition, of a thing is a more or less abbreviated enumeration of its relations. We never perceive it, or think it, except in some relation to others, to its class, its position in the system of things, &c. If for a moment the eye rests on it without at once carrying it over to something else—resembling it or differing from it—this blank *stare* is quickly succeeded by an intellectual *gaze*, which *re*cognises the thing by connecting it with others. Nothing

exists in itself and for itself; everything in others and for others: *ex-ist-ens*—a standing out relation. Hence the search after the *thing in itself* is chimerical: the thing being a group of relations, it *is* what these are.* Hence the highest form of existence is Altruism, or that moral and intellectual condition which is determined by the fullest consciousness—emotional and cognitive—of relations.

24. Since we thus explain (analyse) the seen by means of the unseen, and our knowledge is of *signs* and their *significates*—since, further, these explanations have validity only when they render evident the equivalence of the invisible factors with the visible fact, the virtual with the actual, the inferences with sensations or intuitions, it is obvious that our ideal conceptions must never contradict, but only elucidate, our real perceptions, when applied to phenomena. Our Cosmos has a twofold aspect of Things and Relations, Wholes and Parts, Subjects and Predicates; and each aspect may be separately considered as an ideal, or as a real world. But the division is a logical one; it is analytical, as all divisions are; whereas the Real is a synthesis. If we divide Existence into objective and subjective aspects, and each of these in turn into general and particular aspects, so that we speak of Matter *and* its properties, of Mind *and* its states or acts, this is entirely a procedure of Reflection, and is directly contrary to the Reality given in Feeling and the Logic of Feeling. I admit that the whole of our intellectual superiority over animals, and that of reflecting over unreflecting men, depends on this procedure; but I wish to emphasise the fact that it is an

* See PROBLEM VI. chap. ii.

artifice; and that the final success of the artifice consists in Verification—that is to say, the reduction of ideal conceptions to real perceptions. Thus understood, there is no serious evil in the departure of ideal constructions from the order of real perceptions; and the famous Antinomies of Reason, so much insisted on since Kant, are nothing but the oppositions of the Twofold Aspect. It is true that our visible Cosmos, our real world of perceptions, is one of various and isolated phenomena; most of them seeming to exist in themselves and for themselves, rising and disappearing under changing conditions. While some relations seem necessarily linked together, others seem wholly independent—*e.g.*, we cannot deduce from one property of a circle, such as that of its circumference being everywhere concave to its centre, the other property that it contains the greatest area within the smallest circumference; any more than we can deduce from the property of oxygen in uniting with hydrogen to form water, the other property of uniting with blood discs to sustain vital activity. But opposed to this discontinuous Cosmos perceived, there is the invisible continuous Cosmos, which is conceived as an uniform Existence, all the modes of which are inter-dependent, none permanent. The contradiction is palpable. On the one side there is ceaseless change and destruction, birth and death; on the other side destruction is only transformation, and the flux of change is the continuous manifestation of an indestructible, perdurable Existence. This then is the Twofold Aspect with which Philosophy is occupied, under different impulses. The facts of Feeling which sensation differentiates, Theory integrates. What we experience as

Feeling, we systematise as Science. Hence the speculative effort, thoroughly justifiable, to reduce all phenomena to one cause, all laws to one law, to see the Many in the One, and the One in the Many, as Plato divined. Plato, however, and the majority of his successors, failed to see that this Twofold Aspect of the problem was finally reducible to a common term, and that the Logic of Signs was simply an analytic artifice applied to the Logic of Feeling.

IS CERTITUDE RELATIVE?

25. Many philosophers are dissatisfied with anything less than absolute certitude, and deny this to be attainable. In our former volume it was indicated that the Relativity of Knowledge does not necessarily involve the discredit of absolute certitude within that sphere. We must, however, make clear to ourselves the terms we use. It is obvious that man cannot know what by its definition is placed beyond the range of knowledge; therefore to be rational we must restrict ourselves *within* the human range, and ask whether absolute irreversible certitude is possible there. Knowledge is relative; the horizon recedes as we advance; no sooner is a definite conception reached, than the impetus of search carries us onwards in quest of a conception which will explain (include) it. Restless, because incessantly stimulated, we must advance. Impatient of finality, we make each goal, when reached, a starting-point for further quest. Noble and beneficent in many ways, this unquenchable fervour, which after conquering worlds sighs for other worlds to conquer, has also its weak

and mischievous side, and therefore needs a wise control. How to secure its benefits and escape its dangers, is indeed a difficulty, till we have learned our limitations, and learned to accept them without repining. Resignation without apathy, is the great practical lesson of life. Acquiescence without indolence is the great speculative lesson. Conscious of high aims, and feeble powers, we must do our utmost to extend those powers, and realise those aims, at the same time that we clearly recognise the limits which separate what is modifiable from what is unmodifiable.

26. The limits of Research are fixed by the constitution of our minds. By no conceivable expansion of our faculties, under present external conditions, could Knowledge pass beyond the spheres of the Sensible and Extra-sensible (PROBLEM I. chap. iii.) since even our widest conceptions are but as algebraic symbols, of which the arithmetical values are perceptions; and Philosophy in its loftiest speculation is but the ideal interpretation of the facts of Feeling. This is indeed denied by many illustrious thinkers; and the pretensions of a metempirical doctrine are based on the assumption that speculative insight is not thus circumscribed. Nor is the genesis of this opinion difficult to trace. The tendency of the mind to separate ideally every object from its actual surroundings, in order to understand how it came to be; and the conclusion that an object which presents the same qualities under varying circumstances must have those qualities independently, and itself *be* something independent of those circumstances, lead insensibly to the fallacy that

the object has an existence independent of all circumstances, is something in itself, and to be known in itself. But a thorough investigation of the genesis of Knowledge rectifies this illusion, by showing that whatever things may *be*, outside the relations in which they stand to the Organism, all that they can *be to us* is what they are in *knowable relations;* and these relations are their qualities, which are our feelings. The only rational meaning of the question, What *are* things? what is their nature? is What can be *known* of them? how will they affect us?* The terms of Knowledge being Feelings, no manipulation of those terms can evolve products which are more than symbolical representations of the ways in which the Cosmos stands related to the Organism. Knowledge may be an ideal transfiguration, but its material is Feeling, and its purpose is the guidance of Action. Ideas are symbols which have no values beyond reals, and reals have no expression but in feelings.

Yet although the limits of Research are thus inexorably fixed, Knowledge within those limits is capable of indefinite expansion. The question therefore arises, Whether any conclusions can be absolutely certain amid this variation in the sweep of Research, and the infinite revolutions of Theory which accompany our changing horizons? Is Truth possible, and are there any persistent principles of Certitude to which theories may be referred, so that the readings of the compass may confidently be followed in all seas, and under all latitudes? To put the question in another

* "Was ist denn nun das, was uns durch Empfindung zum Object wird? Nichts anders als Qualität."—SCHELLING: *Transcend. Idealismus*, p. 189.

shape, Can relative knowledge attain absolute certainty ?

27. The only test of the correctness of an inference is its reduction to sensation. The only test of correct knowledge is successful guidance. A vision of the imperceptible conditions which harmonises with the perceptible conditions, must be a true vision in the particular case, although it may be thus limited, and may not be true of any other case. Relative as such a truth must be, it is absolutely certain within its own limits; and may be converted into an eternal truth by converting it into an *identical equation* (see vol. i. p. 404). Even without such an operation, it suffices for its particular application. And as the guidance of Knowledge is mostly tentative, since we cannot pause till Science has given us a perfect theory, but are compelled to *feel our way*, guided by guesses and broken lights, we have two kinds of Certitude, the Practical and the Rational, the one which suffices for Action, the other which satisfies Speculation. The practical certainty with which we conclude that one particular event will follow another, although this inference may turn out to be wrong, determines our conduct; it is different from the rational certainty with which we conclude that two things equal to a third are equal to each other. I have, however, shown that every contingent truth may be transformed into a necessary truth, every equation of condition may become an identical equation; and although we say of the contingent truth on which Practice relies, that it is only true under the specified conditions, and ceases to be true under other circumstances; the same must also be said of the necessary truth on which

Speculation relies, for even the axioms of Geometry are true only within limits. The point here brought forward is that both for practical and rational Certitude the test is at bottom the same.

28. Meanwhile we must remember the Twofold Aspect in which the Cosmos presents itself to Cognition, owing to the two inseparable processes of Feeling and Thought. Just as perceptions are modified by pre-perceptions, and the action of a stimulus is completed by the reaction of the Organism, so are the relations of objects to Sense illuminated by their relations to Reason; and much of our erroneous speculation arises from our inability to reconcile the necessary contradictions of these polar aspects. When, for instance, the concrete fact of Sense declares a mass of marble to be a continuous and homogeneous substance, without interruptions in the continuity of its parts, each part being similar to every other, no one disputes this truth. Such *is* the marble to Sense; and under *these* sensible conditions, such it must always be. But analysis, penetrating beneath the fact of Sense in search of its ideal factors, declares that this mass of marble *is* something very different from what it *appears:* its seeming continuity is broken up into discrete molecules, separated from each other as the stars in the Milky Way are separated; and its seeming homogeneity is resolved into heterogeneous substances, which are themselves in all probability composite. No contradiction can be more explicit. So great is the tendency of Speculation to replace Observation, and so seductive are its constructions, that even ordinary men are usually unable to resist the tendency to

accept the conceptions which have been extricated from perceptions, and the theories constructed out of sensible data as more truly *real* than the very data themselves. Although all ideas are but reproductions and recombinations of feelings, a reality, which in truth belongs to feeling only, is assigned to ideas even when they contradict feelings.

29. We must clear up this confusion by reducing both aspects to their common term, while at the same time vindicating the legitimacy no less than the necessity of the Law of Polarity, or doublesidedness, which finds its expression in Differentiation and Integration, Plus and Minus, Quality and Quantity, Things and Relations, Matter and Motion, Continuity and Discontinuity, and many others, at the head of which must be placed Subject and Object, or Self and Notself.

If we interrogate Feeling and its synthetic judgments, the result is that there can be no community between existences so contrasted as Matter and Mind. The Object *is* only Object in contradistinction to Subject: it is that which is *not* Self. In like manner the Subject is contradistinguished from the Object.

Thus far Feeling. But Speculation, with its analytic judgments, resolves these two seemingly independent existences as abstractions from one Reality, the Object revealing itself as the other pole of the Subject. In a magnet we have a positive and a negative pole, which attracts at one end and repels at the other; and we find that this attraction, and this repulsion, lessen gradually as we pass from each end towards the centre, while at the centre both vanish.

But if we divide the magnet at this central point of vanishing force, we do not separate the magnet into two independent bodies, one attractive, the other repulsive. On the contrary, we find that each half has become a new bipolar magnet; subdividing this, as often as we please, we only get smaller magnets, never separated attractive and repulsive bodies. It should be remembered that there is nothing in magnetism analogous to what is found in electrolysis, the separation of positive from negative electricity seen in the appearance of oxygen at the one pole, and of hydrogen at the other; but each molecule of the magnet is an infinitesimal magnet. Precisely analogous is the polarity of Object and Subject. We may ideally separate the two aspects of Feeling and the Felt, and treat each apart as an abstraction; but the Felt is inseparably involved in every component of the Feeling, and *vice versâ*. It was Kant's fundamental mistake that he adopted the traditional misapprehension on this point, and professed to assign the objective and subjective elements in Experience, as matter and form; and this error is the more noticeable because he altogether repudiated the traditional notion of a separation between the objective phenomenon and the mind which perceived it. The best modern metaphysicians, with rare exceptions, are now agreed that whatever may be the case with ultimate existences, the phenomena we deal with are bipolar, on the one side objective and on the other subjective; and these are the twofold aspects of reality.

30. By a similar reduction, Analysis shows Quality to be only another aspect of Quantity, Matter of Motion, Things of Relations, &c. In presence of such contra-

dictions the question arises, Are we to follow the judgments of synthetic Feeling in believing that both Object *and* Subject, Matter *and* Motion, Quality *and* Quantity *really* exist? Or the judgments of analytic Speculation that the separation is not real, but that the true nature of things involves a doublesidedness of aspect? On which path is the truth to be found? Or may it not be found on both?

On both, under proper regulation. The operations of Analysis are indispensable to the ideal constructions of Science, and may always be accepted, subject to the synthetic restitution of the elements which Analysis has disregarded. Thus, if we understand that the analytic point of view is adopted provisionally, and its results offered only as hypothetical explanations of the invisible factors, there can be no legitimate objection raised against them because *they* deviate from or even contradict the fact they are invented to explain; all that is demanded of them is that, when what they have rejected is restored, they shall harmonise with these restored elements, and the proposed explanation be an integration—*i.e.*, a combination into one whole of the elements detected by Analysis with the elements of the Synthesis which formed the starting-point. Otherwise the explanation is defective.

31. My meaning is, that every single phenomenon being a complex of many, a resultant of various conditions, Science endeavours to explain *it* by separating *these*, and estimating each for itself, and each in conjunction (by analysis and synthesis, therefore), thus unravelling the tangled web thread by thread. Every thread has its law; every law its general expression connecting it with all similar threads. Laws once

established become symbols which can be operated on in security. But—and this is the point too frequently and fatally overlooked—the symbols thus analytically obtained are symbols of abstract (mostly quantitative) relations, and are therefore only integrally applicable to abstract or quantitative questions; so that whenever we need to know what is the *kind* of phenomenon, rather than *how much* there is of it, our quantitative symbols no longer suffice. Because Science is pre-eminently analytical and quantitative, the gradual advance of Science has been a constant encroachment of the symbols of Quantity on the province of Quality; hence the enlarging applications of Mathematics. Indeed very many questions of Quality have entirely resolved themselves into questions of Quantity, *for the physicist*, who is satisfied whenever he can get precise measurements. But for the psychologist it is otherwise. He recognises in Quality a primary fact of Feeling, and in Quantity a fundamental Signature of Feeling : the Quality and the Quantity are indissoluble, and both are analytically reducible to objective elements. The physicist occupied with measurement, having carefully unravelled the thread of Quantity (which is necessarily present in every web), having measured it, obtained its *value*, discovers that between two very different groups of phenomena, webs of widely different qualities, there nevertheless exists under all the sensible diversities, under all the physical *qualities*, a mathematical identity—*i.e.*, the forms of their quantitative relations are the same. (This is of course purely ideal, yet it has its objective correspondence, so to speak.) He disregards the synthetical aspect,

sets aside the sensible qualities of the things quantified, and fixes his eye on the form of the quantity. To find the form that is common to two different groups, belonging to different sciences, is the fortune of genius; and when this has been found—when, in spite of the manifold and manifest differences presented by Light, Heat, and Sound, as quantitative phenomena, these are identified under the common form of Undulations, a great conquest has been effected by Analysis; but still the final explanation is wanting; still we need the omitted Quality to be restored. Undulations, however manipulated, will only yield undulations. The mathematical analyses may possibly exhaust the objective aspect; but there still remains the subjective aspect—the greeting of the spirit.

32. And what is this "greeting of the spirit?" The metaphor expresses that reaction of the sensitive Organism upon stimulus, which is one necessary factor in every phenomenal result, since every phenomenon is at once object and subject.* Between Heat

* Not only must the subjective factor be always allowed for, but such are the variations due to subjective conditions, that it has been found necessary to reduce them to an average by establishing what is called the *personal equation*. Thus, although the beats of a pendulum are the most exact standards we can fix on for the observation of any phenomenon in time, no two persons agree precisely in their interpretation, one being always a trifle in advance of the other. Bessel, the astronomer, found himself noting phenomena in advance of his assistant Argelander by as much as twenty-two hundredths of a second; Mr Sheepshanks found himself forty-five hundredths behind M. Quetelet, and thirty-five hundredths before Mr Henry. Now in Astronomy such variations would lead to enormous discrepancies of calculation; hence the necessity for the *personal equation* to be fixed by the observers before they set to work. Nor has even this the requisite precision for delicate operations, since not only is the personal equation itself a

and Light, considered as mere undulations of Ether, there is only a quantitative difference; and analytically we may admit that non-luminous heat-rays become luminous when the rapidity of vibration is increased or diminished. But this is presupposing that the omitted factors are restored, and that the reactions of the Organism, which analysis takes no account of, accompany the objective changes, since it is they which endow the heat-rays with the quality of heat, and the luminous rays with the quality of colour. Vibrations of Ether, having luminous rapidity, would beat in vain upon the skin-nerves, no Light would thereby exist; nor would transverse vibrations of any rapidity produce Heat through the retina. Analysis may some day, and perhaps that day is not very distant, reduce the diversities of Feeling to quantitative diversities in the neural excitation, so that characteristic numbers of neural units will be assigned to special sensations, no less than to their stimuli. But even after identifying Heat and Light as quantitative varieties of the same Ether, or simply as modes of motion, and completing this by identifying their corresponding feelings as quantitative varieties of the same neural excitation, also modes of motion, Analysis will give only the weaver's side of the tapestry, the blind man's conception of light—and will need its complement of Synthesis. (Comp. RULE XII.)

33. But the different reaction of the sensitive organs

variable, depending on the internal state of the observers, but there is this further complication, that no observation which rests on the comparison of *two* senses can be absolutely accurate.

See *Comptes Rendus*, 1864, Sept. 12. A brief yet full history of the personal equation is given by EXNER in *Pflüger's Archiv für Physiologie*, 1873, p. 601.

which creates the difference between the two radiants we name Heat and Light, is not the only factor involved in the greeting of the spirit. There is the further co-operation of Thought. The phenomena are not only felt, they are reflected on. Our perceptions are extended and modified by conceptions, so that we not only see the visible effects of Heat and Light on other bodies besides our own, but we have a mental vision of invisible effects, and judge that these things are all that their appearances connote. To the mind of a philosopher every fact of colour is a complex of visible and invisible facts, which differs from what it is in the mind of a child or a peasant, as the idea of a lily in the mind of a botanist differs from that in the mind of a savage. Enough allowance is not made for this vast modifying influence over our ordinary perceptions—this exaltation of actual sight by spiritual insight;* and the consequence of this neglect is that we frequently confound the product of pure conception with the product of direct perception, and suppose we *see* what in truth we only *think*. To the "personal equation" must be added the "spiritual equation."

34. We have already seen how knowledge is composed of Feeling and Thought, and that Existence

* The phrase "spiritual insight" will not be misunderstood as implying agreement with the hypothesis of a Spirit, any more than the phrase "psychical phenomena" implies an acceptance of a Psyche. I use it to mark a distinction, not, as the spiritualists use it, to connote an entity. LUTHER said he saw no reason why the Devil should have all the best tunes for his service; nor need we allow our opponents to have all the good phrases; and as SENECA in one of his letters describes himself entering the enemy's camp not in desertion but in search (*soleo et in aliena castra transire, non tanquam transfuga, sed tanquam explorator*), so may we pass over the enemy's lines in search of arms. "Spirit" is a very good word to contrast with matter and motion; but it is metaphorical, and so is "insight" metaphorical.

necessarily presents a real and an ideal aspect to Experience. There is thus a logical truth, and a real truth. The validity of each within its own province is unaffected by any contradiction from the other. But the guidance of the one is in Speculation, whereas the guidance of the other is in Action. When we say that an image or an idea has *ideal existence*, we mean that it is a mental phenomenon having its place among others, with relations which determine its significance in the course of Thought; but although it has its place there, we do not for a moment suppose that it has a place in the real world, that it is capable of being manipulated, capable of exciting various feelings in us, or of being placed in relation with various senses. The dagger which hovered before Macbeth's imagination could not be clutched by his hand like the one he drew; it could not be used to kill Duncan; the "gouts of blood" upon its "blade and dudgeon" no eye but his own could see. The dagger appeared to Macbeth: and this ideal existence was a fact, in spite of its being contradictory of every real test.

CHAPTER II.

IS AND APPEARS.

35. At the close of the last chapter we came upon a topic which has been incessantly agitated in the schools, and which leads right into the heart of the problem of Certitude. To know things as they *are*, apart from their *appearances*, is considered the grand desideratum. While in one sense the distinction is of obvious validity, in the sense in which Metaphysic commonly understands it, nothing can be more illusory. The great majority of philosophers declare that since knowledge is necessarily relative, we must be for ever shut out from a knowledge of things as they are. We cannot, it is said, "penetrate the real nature of things"—their intimate structure is screened from us. We can only know how they affect us. Behind this world of Phenomena there is an impenetrable world of Noumena. Behind this apparent existence there is a hidden existence, of which the varied phenomena are but fleeting manifestations. Things in themselves are necessarily different from Things in relation to us.*

* It is against this traditional opinion that Goethe energetically protests in the well-known lines :—

> "In's Innere der Natur dringt kein erschaffner Geist,
> Zu glücklich, wenn er nur die äussere Schale weist.
> Das hör' ich sechzig Jahre wiederholen,

36. The answer to this sceptical difficulty may be given both from the conclusions of Philosophy, and the conclusions of Common Sense. The first show how Things are congeries of Feelings, certain groups of neural units being fixed in names; and although these neural units, and their groups, are themselves determined by external no less than internal conditions, they never lose their character of Feeling. In this sense, therefore, it is obvious that the Things we feel are our feelings; they are objective as the Felt, subjective as the Feeling. Nor does the view of Common Sense differ from this, since all men irresistibly accept the phenomena presented to them as presentations of reality. They believe the things are what they are felt to be; that its colour, no less than its form, is a part and parcel of the flower; that the stone is hard when it is felt so. And when this First Notion is rectified by Science,* and an insight into psychological processes teaches us that knowledge is a product of two factors, the organism and the medium, the knowing mind and the object known, we come round to the starting-point, and still say that to know a thing as it *appears*, is to know it as it *is* under the objective and subjective conditions of its appearance.

> **Und fluche drauf, aber verstohlen,**
> **Natur hat weder Kern noch Schale,**
> **Alles ist sie mit einem Male."**

And HEGEL, who cites these lines, has expressed the same view: "Es ist der gewöhnliche Irrthum der Reflexion, das Wesen, als das bloss Innere zu nehmen. Wenn es bloss so genommen wird, so ist auch diese Betrachtung eine ganz äusserliche, und jenes Wesen die leere äusserliche Abstraktion." *Encyklopädie*, § 140.

*** On First Notions replaced by Theoretic Conceptions, see PROBLEM IV. § 23.**

A thing being a group of relations varies under varying relations. Obviously this changing group will not be the same throughout the changes, but it is here and there precisely what it appears here and there; the manifestation changes with the conditions. A word has no meaning, does not *exist* as a word, except in relation: the meaning lies in the context. So with the sensibles, which are the signs of things.

What the popular distinction between a thing and its appearance truly indicates is, that we regard the thing as the group of all its known relations, and its appearances or manifestations, here and there, as specifications of one or more of these relations; when we say the stone *appears* large or small, grey or hard, cold or rough, but that it *is* far more than these, we might equally well say the stone *is* these in these relations.

37. The famous distinction, therefore, between is and appears is either a logical artifice, or a speculative illusion. The logical artifice points to the distinction between general relations and particular relations. The speculative illusion assumes that the knowledge of things being only of appearances can never be a knowledge of things as they are in their inmost nature. The ontologists, believing in the reality of this distinction, but unwilling to accept the sceptical conclusion, waste their energy in the pursuit of this phantom Existence—the Noumenon lying "behind the field of phenomena." Starting from the phenomenon, which is the given product of two factors (on their own admission), they attempt the feat of determining what this product *would be* were one of the factors removed—which can only mean how it would

then *appear* to them. Our utter inability to form a conception of the aspects which known objects would present to a new sense, ought long ago to have shown the inanity of speculating about the aspects of things in relations not sensible; and ought to have closed for ever the disputes about the Supra-sensible. The logical distinction between the inward essence and the outward appearance is simply this: the Thing considered outwardly, *i.e.*, in its presentation to Sense, is the Thing in definite relations; but besides this, we conceive the Thing as *capable* of other relations which are not definitely specified, or as existing in indeterminately fluctuating relations,—a mere possibility of appearance.*

38. The task of research is to fix precisely the conditions of each successive appearance, not to go in quest of the phantom *Thing in itself*, which never can appear.† The illusion of an existence underlying the appearance arises from our tendency to dissociate abstractions from their concretes, and endow the former with a permanent reality denied to the latter. We have feelings to which we assign external objects, and similar feelings which we learn not to be assignable to external objects. The one class are said to be real perceptions; the other to be imaginary. Between the reality of our waking sensations, and the phantasma-

* Compare HEGEL, *Encyklopädie*, § 139: "Was innerlich ist, ist auch äusserlich vorhanden und umgekehrt; die Erscheinung zeigt nichts, was nicht im Wesen ist, und im Wesen ist nichts, was nicht manifestirt ist." The final clause, however, is only acceptable on the idealist hypothesis of the manifestation to us including the whole Being.

† GOETHE wisely forbade the "search for what might lie behind phenomena; it is the phenomena themselves that form the doctrine—man suche nur nichts hinter den Phänomenen; sie selbst sind die Lehre"—and I would add—"hinter ihr das *Leere*."

lity of our dream perceptions—between the dagger which Macbeth drew, and the dagger which proceeded from his "heat-oppressed brain"—between the fruit lying on the table, and its reflected image on the surface of a mirror—between the serpent I dissected yesterday, and the dragon which terrified my ancestors, the contrast is marked. But what is it in all these and other cases, which distinguishes the real from the unreal? Not the feeling as such. That is real in both. The fruit-image is a real image, but not a real fruit-object. The vision of the dragon, and the terror it excited, were real feelings, and played a part in the experience of our forefathers, in some respects more important than any of the feelings excited in me by my dissected serpent. If, then, it is not the feeling *alone* which characterises the perception of a real, it must be some inference from the feeling, since feelings and inferences (which are ideal reproductions of feeling) make up the whole of material consciousness. In dreams and hallucinations we are unable to reduce our inferences to sensations, and therefore unhesitatingly believe in the reality of our visions. But in waking and sane states we are incessantly checking inferences, either by reducing them to sensations, or by inductions from other sensations. Thus, a child seeing a fruit on the table infers that there is an object which, besides looking like one he has seen before, will also, if put into his mouth, taste like the fruit it resembles in shape and colour. He will have the same inference excited by seeing the image in the mirror. Trial will convince him that there is no taste to be got out of that image. Nor can he handle and smell it. He therefore judges that this image is not

what the other was—he does not see a fruit; and since the image vanishes when the fruit is removed from the table to reappear when it is replaced on the table, or brought opposite the mirror, he learns that the fruit may appear in one place and its image in another. When thus instructed, he is able on future occasions to interpret certain marks which distinguish the fruit-image from the fruit-object, and he no longer infers that the fruit-image surrounded by the accessories of the mirror surface, or water surface, or picture frame, will yield to touch and taste the same sensations as are yielded by the fruit-image surrounded by the accessories of trees, tables, plates, &c., which in his experience are associated with those sensations yielded by the image. The immediate judgment of the man, and of the child, on seeing the reflected image of a fruit, would be the inference that a real fruit was there; but this judgment is rapidly checked by the intervening inference from the sight of the reflecting surface. In the one case the inference from the image is that when other senses are applied there will be sensations of solidity, fragrance, sweetness, &c.; and if this inference is correct, we say the image is that of a real fruit: reality meaning congruity of inference and sensation; and appearance (in contradistinction to reality) meaning that the inference is not congruous with sensation. But the appearance of the image is real: the image is what it appears to be, not what it suggests beyond itself.

39. Thus the only meaning we can attach to Reality is that every Real has a corresponding feeling or group of feelings, some of these actual, others virtual. Reals are objective judgments; and judgments are groups of subjects and predicates, sensations and inferences. A

blow on the eye, for instance, excites among other feelings, one that is indistinguishable from the feeling excited by objective sparks. We do not, however, say that in this case there is a *luminous* real exciting the retina, because, although the actual feeling may be similar, the virtual feelings (which also enter into the group named Light) are proved not to co-exist with the actual feeling in this case. We cannot see objects with this subjective light. We cannot screen it from the eye, split it into a spectrum by a prism, converge its rays by a lens, or manipulate it in any way.

But although we cannot lay hold of this subjective light, and make it comport itself to other senses in the way objective light comports itself, we know first that this subjective light is a group of feelings, therefore real, according to the definition. We also know that the group is decomposable into molecular changes in the nervous system, due to external causes, therefore in this sense also real. It is not the same real as the objective Light, simply because the conditions differ —it is a group of other components.

A shadow is real, though it is not a solid; a motion is real, though it is not a substance; and a feeling is real, though it is neither substance nor motion. Why? The shadow, and the motion, are real, because each is a group of feelings. The shadow is decomposable into its physical conditions, and our feelings. So with the motion. So also with the feeling. Objective and subjective factors co-operate. But although this is acceptable in Speculation, it is not in accordance with practical usage. The need for a distinction between objective and subjective aspects, between permanent and transient possibilities of sensation, has led us to

denote those groups as real which unite with present sensations the possibility of exciting other sensations (§ 38). Thus, the object which reflects rays of light is distinguishable from the shadow thrown by the object, and in two ways: First, the object is capable of exciting various feelings besides those of sight, of which the shadow is incapable; secondly, as a derivation from this, the object has its ground of existence in unknown conditions, personified in the abstraction *substratum*; which in other words is saying that it depends on forces we are unable to enumerate or estimate, and these constitute its essence, its reality apart from our perceptions; whereas the shadow has its ground in known conditions, and having thus no need of an unknown *substratum*, its reality is coextensive with these conditions, which are merely changes of position. We see that it depends on interception of the rays of light, arises with, varies with, and vanishes with this interception and this light. As I am here only adverting to the popular distinction, and not to its philosophical validity, I need only add in passing that the distinction is not speculatively tenable, but that there are unknown conditions present in the one case as in the other. We say of the object that it is real, however, because it is capable of exciting those feelings of resistance with which we associate reality outside of us. It manifests force. The shadow manifests none, or none that we recognise. The object is real, because all our judgments respecting it are congruous; the feelings inferred to be the consequence of touching it, weighing it, tasting it, smelling it, &c., are, on experiment, felt in it. If we have judged the shadow to be real, *i.e.*, judged that what we shall feel in it will be congruous

with what has before been felt in solid objects, the trial undeceives us. Congruity of experience is thus our test.

There is another distinction. An individual plant or animal is real: its annihilation would alter the whole Cosmos, by disturbing the present distributions of Force. But Species, Genera, Classes are not reals—though often mistaken for such. And this not because they are ideas, and therefore states of the Subject, for the perceptions of individuals are also subjective; but because they have no *other* objective correspondents than exist in the elements to express which these symbols are formed. The proof of this is not simply that they are ideal construction out of real feelings, but the fact that were they one and all annihilated, it would not cause the slightest perturbation in the system of things, it would only alter our intelligent grasp of things.

40. Besides the distinction between objective and subjective Reality, which vanishes under speculative analysis, there is the convenient artificial distinction between Reality and Appearance as between deep-seated resemblances and superficial resemblances,—congruous judgments and incongruous judgments. Thus, a man appears to be wealthy, because we judge from certain details in his style of living that his means justify that style; perhaps he is not wealthy. If we act upon our judgment, we find the result incongruous with our inferences. Again, the moon appears larger when at the horizon than when at the zenith. It always appears so, and to all men. Whether this appearance be due to a wider visual angle, or to an illusion of judgment influenced by surrounding circumstances, the sensible

fact is that the moon is seen as larger at the horizon; and the inference from this sensible fact is inevitable, that the moon really is larger. But here the philosopher steps in, and corrects this inference by an inference drawn from other data, which assure him that bodies do not change their volume merely by passing through space; whence he concludes that however the moon may appear, it *is* not larger at the horizon. By this he means that if the spectator were able to measure the moon first in one place and then in another, the *two measurements would coincide.* We accept his correction, we admit the ideal fact; but we remark that his correction of our sensible judgment is only the displacement of one fact of sense by another. He says that the moon is not larger, only appears so, when at the horizon. Yet what is his proof of this? Simply that the appearance which the moon has in one relation is different from what it has in another relation—and that if, instead of looking at the moon as it really appears (in Feeling), we looked at it as it ideally appears (in Thought), we should no longer see this apparent difference. All which is indisputable; but does it warrant the conclusion, so often drawn, that neither the real nor the ideal appearance of the moon discloses what the moon *is*, but discloses simply its phenomenal aspect to us? Surely the moon is in each case what it appears? Each aspect is that of a specified relation, in which the objective cause stands to the subjective feeling;—it—"the moon"—is only cause, is only a feeling, as a product, one factor of which is the "greeting of the spirit:" it—"the moon"—has no existence out of this specified relation. In some *other* relation what is here the moon's objective factor

may be—must be—another existence; but this objective factor is not, cannot be, our moon; and the search for this existence is either the rational search for other *aspects*, or the irrational endeavour to ascertain what a thing really is—when it is *not* real.

The common objection urged against empirical knowledge is, that it only grasps particulars, only tells us what things are in particular relations, and is therefore illusory as regards the truth of things. It is an objection founded on a profoundly erroneous view of the relation of particulars to generals, and of perceptions to conceptions. Because an experience is particular and limited, that is no reason why it should be illusory; it is illusory when generalised beyond its limits; it is true within its limits. A general, or an universal, experience is only the sum of particular experiences expressed in a symbol; and a general conception is only the sum or symbol of its particular perceptions. My conception of the moon is more general and diversified than any one perception of it, but is nothing more than the condensed results of all my perceptions (aided by the perceptions of others).

41. Not further to dwell on this topic, which must be more fully discussed hereafter,* we may without danger of misconception proceed on the supposition that the proper distinction between *is* and *appears*, instead of having the character of the metempirical distinction between noumenon and phenomenon, has the empirical character of ideal and real, or of general and particular. Every thing, object, event, is at once general and particular, according as we view it as the ideal representative of certain general relations, or the

* See PROBLEM VI. chap. ii.

real manifestation of certain special relations. Each Thing is a group of Relations—a conjuncture of events. We may view it synthetically as a group, as a conjuncture; or we may view it analytically in its several elements. That is to say, we may dissect what is *given* as a whole of Feeling, into what is *inferred* to be its constituent parts. We have what is Here; and we seek to conjure up ideally the vision of what *was* There, and *will be* Elsewhere. The ideal reproduction of past experiences is absolutely necessary for Knowledge. Without it we should be as the blind, who have to feel their way, and cannot "touch afar," like those who see. But important as the ideal complement of real feeling may be in guiding our actions, we must never forget that it is liable to illusion; and that however indisputable some proposition may be which concerns only ideal aspects, it may be inapplicable to real aspects, therefore have simply an abstract truth.

ELEMENTS.

42. The difference between an abstract analytic truth and a concrete synthetic truth may be illustrated in an example which presents them in open contradiction. Are there really elementary substances, and how are they defined? For practical purposes a substance is provisionally held to be elementary when its decomposition into other substances has hitherto baffled our resources; iron, gold, oxygen, carbon, and upwards of sixty other substances have taken the place of the four elements recognised by the ancients, but probably no philosopher in our day regards these otherwise than as substances which have not been decomposed. The expectation of some day

decomposing these, or of displaying them as various modifications of one substance (Hydrogen is most in favour) prevents their being accepted as real ultimates.

Here, then, is one contradiction. The sensible fact of experience is that iron, gold, &c., are simple, homogeneous substances. But this fact is pushed aside by the conception of their possibly composite, heterogeneous structure; and Theory so dominates over Observation, that the structure of these substances which we ideally picture is suffered to replace the structure we really observe. We think it probable that future discovery will justify the conception by disclosing that these substances are compound; and having once thought this probable, we easily come to think it real. We then say these substances *appear* to be simple and homogeneous; they *are* composite and heterogeneous. In other words, they appear homogeneous to a limited experience of their structure; but by extending that experience through *other* appearances, we shall learn that their structure appears heterogeneous; and this extension of experience (as the finality of the time being) we hold to reveal what the structure really *is*. Such finality is, however, admitted to be provisional. We cannot exclude the idea that further research may reveal these supposed heterogeneous elements to be identical—that is to say, only different degrees of energy of one and the same element.

43. This leads to another contradiction. The idea of an elementary substance is that of a substance which remains unchangeable throughout changing external relations, preserving its integrity of structure, and all its essential attributes unaltered. Iron, for

instance, is always iron, always the same, whether we find it in an ore or an oxide, in blood-discs, or in tramways; oxygen is always the same, preserving unchanged all its qualities, whether it appear in water, carbonic acid, or blood. So says Theory; and the experiences which Theory formulates are ample justification. The oxygen which was isolated in a retort, and there weighed and tested, can be united with hydrogen to form water; it will seem to disappear in that union, all its characteristic qualities having vanished, no trace of what we call oxygen remaining; but from this water it can at any time be restored to the retort, and, when extricated from the embrace of hydrogen, will be found to have preserved intact all those characteristic qualities which seemed to have been lost. It *is* the same, because its appearances are the same; yet we infer that it *has been* the same throughout, even when appearances are different.

And what says Fact? What is the plain inference from sensible experience? It is that both oxygen and hydrogen have in combination lost all their specific qualities, and have acquired new qualities. They have not only lost that amount of molecular agitation which kept them in their gaseous state, they have lost those qualities, or modes of reaction, which distinguished them from other gases and solids. The oxygen will now not oxidise, the hydrogen will not flame. If this is not destruction, destruction has no meaning; if this is not change, nothing is changeable. Theory declares that the oxygen has not changed; and Fact declares that the oxygen has utterly changed. Theory infers that the oxygen is indestructible, in spite of the fact that oxygen has been destroyed; that is to say,

the atom O persists although the molecule O_2 has vanished; the bricks remain although the house is no more. The surprising recovery of all the original characters, after the element has undergone a multiplicity of changes destructive of those characters, is supposed to prove that what is thus recovered could not have been lost. Hence the conclusion is drawn that throughout its apparent changes the element has really preserved its integrity. But looked at closely it is seen that all which remains the same is the possibility of a restoration of the qualitative phenomenon when its necessary quantitative conditions are restored—in other words, what is now lost will reappear whenever the requisite conditions of its appearance are restored. The house will reappear when the bricks are rearranged. In the ideal region of Possibility this ideal element preserves its identity. In the region of Actuality the real element has become different. If destruction be recognisable at all, the oxygen is as completely destroyed when it passes with the hydrogen into water, or with the iron into rust, as a plant is destroyed when eaten and assimilated into tissue by an animal. There *was* a definite group of sensible qualities, that is to say, an objective existence having certain modes of reaction, by which modes it was specified; and this group—oxygen, iron, or plant—*is* there no longer. Why, when we see that the group and its modes have been changed, do we infer that the group has not been changed, although its modes have been? Obviously this is because we have supposed that the logical distinction, between a group and its modes, has a corresponding real distinction, the sum not being the sum of its integers, the whole not being

the whole of its parts! And here this abstraction 'group' stands for the reality, the concrete modes out of which the abstraction was raised standing for the 'mere appearances.'

44. Perhaps the objection may be started that the oxygen, or other elementary substance, is proved not to have really lost its qualities in combining with another, by its reappearance unchanged when the decombination is effected, whereas the plant once eaten and assimilated is destroyed for ever—no recovery of that group is possible. The objection is vain. We cannot, it is true, with our present means, nor perhaps shall we be ever able to extricate the plant from the tissue into which it has been assimilated. Nor could we, until within the last hundred years, have torn the oxygen from rust and water. But because the process of combination is by us reversible in one case, and irreversible in another, this limitation of our power is no proof that the process is only of apparent destruction in the one case, and of real destruction in the other. Could we step by step reverse the process by which the plant was assimilated, we should finally recover the original plant with all its qualities unchanged, precisely as we recover the oxygen. Are we then justified in asserting that in spite of our inability to recover the plant, in spite of our senses, which declare that it is destroyed, the plant integrally preserves its existence throughout all the multiplicity of changes which it appears to undergo? We are not justified.

45. In this pinch of table salt there is no appearance of the soft metal sodium, or the pungent gas chlorine, which the mental eye of the chemist sees there,

and which all men of science would declare to be really there, supporting their assertion by dragging out both metal and gas, and presenting them to Sense. I, on the contrary, maintain that neither metal nor gas *is* there ; and my assertion is supported by the fact that so long as the salt remains *salt* no trace of *gas*, or *metal*, can be perceived. To prove his assertion that these elements are really present, underlying the appearances, the chemist has to completely alter the whole group of relations, and for that group substitute a different group—*then*, indeed, metal and gas will appear. But suppose a gambler having by successive losses been reduced to his last crown, his despair over the wreck of a fine fortune would not be changed on being assured that his money was only transferred to the bank, that it was not really lost, nor was he really ruined, because although the money had passed so entirely from his control that he was now unable to pay his hotel bill, yet the croupiers need only hand back the money,—or with his remaining crown he need only begin a run of luck which would reverse the process, and so restore all the money he had lost —then, indeed, the fortune would not be lost. On this imaginary reversal of the facts the result is also reversed, *in imagination;* and thus considered, the gambler may appear to be not ruined. Meanwhile he knows that he *is* ruined, and that he *appears* so to himself and others. He is this under present circumstances ; he would be other under other circumstances. In like manner salt is salt, not gas and metal. It is really what it appears to sense, not what it ideally appears to theory ; it is what it is, not what it was, or will be.

46. The meaning of objective reality is capability of being felt—a sensible, not an ideal, appearance. But the reader who has attentively considered the distinction between the real and ideal worlds, the worlds of particular Perception and of general Conception, will not need to be reminded that an *ideal existence* may be assigned to an *ideal appearance*, without hurrying us to the conclusion that the appearance to the mental eye more truly tells us what the thing *is*, than the appearance to the eye of Sense. When the philosopher assigns a deeper reality to the conception in his mind than to his sensible experience, he is assigning a deeper reality to a symbol than to the things symbolised. The conception only *represents* his sensible experiences, it is not the sensibles themselves; and since in the very nature of its formation the conception necessarily alters, rearranges, and rejects many elements of the perceptions, this symbol cannot be an accurate *transcript* of reality, but must be a *substitute* for it, which requires to be retranslated into sensible experiences if a real value is to be assigned to it. Nay more, in consequence of the freedom of combination of the elements of experience, the order of Nature, the sensible order, is not only thus departed from, and an ideal order substituted, but very often in this process of recombination there is a distortion, so that the substituted order becomes a travesty of the real order. It is thus that error, false reasoning, and plastic imagination come into play.

47. There are thus two meanings of the word *is*, a direct and an indirect, a real and a metaphorical meaning, both being equivalent to *appearance*. The direct and ordinary meaning expresses that a sensible

experience has a correlative external object, or real. The indirect and metaphorical meaning expresses that an idea actually exists in the world of thought, and that this idea is a symbol which has its correlative in the group of experiences symbolised, which may be either generalisations of sensibles without modification of their order, or generalisations with more or less modification of their order, but in no case accurate expressions of sensible facts. The interpretation of the appearances given by Perception consists in the reduction of the inferences to sensations; when that has been effected, the reality of the appearance has been proved. In like manner the interpretation of Conception consists in the reduction of the symbol to the sensations symbolised; and when that has been effected, we learn in how far the idea corresponds with, or departs from, the reality which can be reproduced in Feeling.

48. In reference to Idealism, and to many other questions of Metaphysics and Science, it is of the utmost importance to bear in mind the cardinal distinction between real and ideal existence. We are not to deny the validity of ideas because they are symbols only, for these symbols very often are translatable into reals; but we must deny the validity of ideas which are not translatable. Thus, to take extreme cases, the idea of Quantity is an abstraction not less removed from any objective sensible than the idea of a Hippogriff; both are ideal constructions out of real perceptions; both have ideal existence—*i.e.*, their definite position in the world of Thought; but the one is, and the other is not, a valid conception when applied to reals. Quantity, although not a real

existence, is an abstraction from reals primarily given in Feeling, generalised without undergoing modifications of transposition and recombination. It is a symbol which so accurately represents objective existences that it has not only a whole science to itself, but becomes the instrument of measurement on which all sciences depend. The truths of Quantity are ideal truths, representing real relations, and capable therefore of being retranslated into perceptions. Nothing of this is true of the conception Hippogriff: it may be employed indeed by the poet, but must be confined to the poetic region; the sensible elements, whose recombination has furnished the conception, may be specified; but the recombination has not followed the real order, and therefore the conception cannot be applied to reals.

We may now pass to the examination of what properly speaking must be regarded as Truth.

CHAPTER III.

WHAT IS TRUTH?

50. PHILOSOPHERS before Pilate had asked and answered the question, What is Truth? but could not answer it to each other's satisfaction; philosophers since Pilate have been equally at variance when they attempted a definition, although generally in agreement as to the existence of ascertainable Truth, and of marks by which true propositions could be distinguished from false propositions. Whatever interest this question might have for logicians, it could have little for others, were there not connected with it the further question respecting Reality and Appearance. A proposition which is logically perfect is sometimes denied to be *true*, because it formulates only the appearance of things, not what things are. This is the stronghold of Scepticism, and is an arsenal for weapons of metaphysical controversy. A logically perfect proposition is true for all that it formulates, and no proposition is true for more; whether it formulates appearances or realities according to the popular distinction, is a second question, to be answered on other grounds. Error, which is a wandering from the path of Truth, begins with the first step beyond the limits formulated.

51. The animal and the infant have no concern with Truth, but very serious concern with Right Guidance. They have no need to express their feelings and thoughts in the form of propositions (and it is only in respect of propositions that Truth or Error can arise), but they do need to ascertain that order in feelings which corresponds with the order in events accurately enough to guide them rightly in their actions. To know that a certain feeling of colour, or scent, will be followed by certain feelings of touch or taste, pleasure or pain, suffices to guide them in approaching or avoiding the coloured and scented objects. The Logic of Feeling carries the conclusion that such will be the succession of feelings following the order of events. This conclusion may be elaborated by the Logic of Signs into a general proposition, and then the truth or error of the proposition emerges. The Logic of Feeling may err, and from the same causes as the Logic of Signs. The child, or animal, finds that sometimes the anticipated succession of feelings does not occur. Instead of the pleasant taste *logically* connected with a particular colour, another, and perhaps unpleasant, taste is *really* felt. Instead of the soft yielding touch, a harsh resistant touch is felt. The shock of surprise calls attention to the discordance between this experience and former experiences. Doubt now begins. If vividly impressed by the shock of surprise, the animal or child will hesitate when next this coloured object, or one like it, is presented; images both of pleasurable and painful feelings will arise, and the only mode of ascertaining what the object really is, *i.e.*, whether it will excite the pleasurable or the painful feelings, is that of reducing

inferences to sensations. The first conclusion is: this coloured object may excite pleasurable *or* painful feelings, since both successions have been experienced formerly. The second, or verified, conclusion is: this coloured object *does* excite the pleasurable feeling, since this is what is now actually felt. Observe that this verified conclusion is expressible in the identical proposition that the object is to Feeling what it is felt to be. This we shall presently see to be the fundamental form of all Truth (understanding Truth to be limited to propositions).

52. The child having learned to discriminate right inferences from wrong inferences, by finding the first lead to pleasurable, and the second to painful results, also learns in the course of his development to supplement and extend this primary Logic of Feeling by the Logic of Signs. He then begins to attend to what passes within, no less than to what passes without. *Within* he finds feelings and images which have an order of coexistence and succession; *without* he observes things and events which have also an order of coexistence and succession. Sometimes the internal and external orders correspond, the succession of feelings being the same as the succession of events. Sometimes this correspondence is at fault. And sometimes there is a blending of feelings and images which has no correspondence in any external order—mere dream-figments, or representations of what is possible, but not real.

The logical process is the same in Feeling as in Thinking; the test of its correctness, or Truth, we have seen to be in both the same. Their difference lies in the elements grouped, the symbols operated

on; not in the grouping process. The inference of the animal, that a feeling which has followed a particular act will follow it again, cannot by the animal be *expressed* in a proposition; but the logical process of Inclusion is the same both in the mind of the animal and in the mind of a philosopher. Because the animal cannot express this inference in the terms of a proposition, he can only test its *correctness* by the reduction of the inference to sensation; but the man, because he can express his experience in the terms of a proposition, can test its *truth;* and this test is equivalence of the terms; which equivalence is finally proved by the reduction of inference to sensation, or to intuition. Right guidance is the test of correct inference, whether the guidance be that of Action or of Speculation.

THE CRITICISM OF INFERENCES.

53. Every judgment, whether in the Logic of Feeling or the Logic of Signs, is an act of grouping, by which the *predicate inferred* is identified with the *subject perceived*, or *conceived;* in other words, with the quality, or group of qualities, actually present to Feeling, there is affirmed to be a further quality virtually present, and which will be actually felt directly this inference is reduced to sensation. When we see the group known as sugar, we judge that it will be sweet to the taste, and will dissolve in water. Our judgment is the reproduction of previous experiences; it rests on the tacit assumption of sameness or equivalence between the conditions of the previous and the present experiences. In this assumption lies the possibility of error, and the necessity of criticism.

When criticism has been satisfied, and the equivalence proved, the judgment is unassailable.

54. There are thus two kinds of Judgment, the Logical or Intuitive, and the Critical or Reflective. The first is the simple act of inference, in which two terms of Feeling are identified, linked together; or in which the relation of two terms is intuited, but the grounds of this identification are not apparent. When we now judge that sugar is sweet, or that $2 + 2 = 4$, we have not always present to consciousness the grounds which will justify these judgments; neither is the chemist always conscious of the grounds when he affirms sugar to be a hydrocarbon: this judgment, which seems strange to the uninstructed, is to the chemist now an intuitive, it once was a discursive, judgment: it is the immediate reproduction of previous experiences, and can be justified, if need be, by a discursive exposition of its grounds. This is the second kind of judgment. In it the act itself is the object of Reflection. Having drawn an inference, we proceed to criticise it by searching out the experiences it expresses. If any one asks me what is the second power of 8? I answer 64; and this answer is immediate when I *remember* that result of calculation; or discursive when, not remembering, I have to *perform* the calculation. Any doubt on my part, or on the part of the questioner, is allayed by exhibiting the equivalence of 8×8 and 64. We are incessantly forming judgments which have to be thus criticised. The criticism may be either experimental, which reduces the several inferences to sensations; or reflective, which analyses the conceptions into their perceptive elements; and when the grounds of the

judgment are thus brought into view, we see whether there is or is not an equivalence between them. That the sugar previously tasted was sweet, is indisputable; and that this sugar so long as it remains unchanged will always be sweet to my organ of taste while that organ remains unchanged, is also indisputable; but my inferences that this object now before me is in all essential respects the same as that sugar, and that my organ of taste remains unaltered, are inferences which, indeed, we are obliged to make, but which may nevertheless be erroneous. Reflection on the acts discloses how they may be true, and how false; but it is only by the final test of Feeling that they can be proved true or false.

55. Inference is the tacit assumption of equivalence; Reflection is the explicit statement of the grounds of this assumption; Criticism—experimental or analytical—is the testing of this assumption. Since Science is but Experience systematised and clarified, its established truths may be taken as the equivalents of Experience; and thus what cannot be strictly tested through Feeling, may be indirectly, yet securely, tested by Thought.

Reflective judgments acquire the form of necessity when they have withstood the double criticism of displaying their grounds—(the calculations being checked step by step)—and their agreement with Experience; so that the propositions are expressions of identical equations. The propositions "sugar is sweet," and "the square of 4 is 16," are the assertions that there is a relation of equivalence between sugar and sweetness, and between 4^2 and 16. The proposition "sugar is a hydrocarbon" may be expressed in the chemical

equation, Sugar = C_{12} H_{22} O_{11}. These are reflectively seen to be identical propositions. But there are judgments which are conditional, as when we say that water boils at 212° F., which is only true under ordinary pressures; and propositions of this kind are *equations of condition* which are capable of being converted into identical propositions by specifying the conditions. It is obvious that if $x = y$, then $y = x$. We are but saying the same thing twice over, reversing the order. If now we find that $y = f$, then since y has the same value as x, we see that $x = f$; and thus, although at first sight it is not an identical proposition to assert that x is the same as f, or is equivalent to f, we see how it may be reduced by reflection to an identical proposition.

56. Merely to guard against possible misconception, let me note, that although an equivalence in the terms of a proposition is the truth of that proposition, and although every truth may be expressed in the form of an equation, the objective validity of that proposition must depend on the objective values of its terms, and not on the form of the equation. Thus, we may say, "Water = OH_3." As to mere form, this is equally good with the true one: "Water = OH_2;" and taking it as our starting-point, we might develop a series of chemical formulæ, all of which would have a rational aspect, although every one of them would be objectively false. As a great deal of metaphysical speculation is of this illusory nature, it is worth our while to ascertain wherein the falsity of the one and the truth of the other equation of water discloses itself? It is disclosed by a criticism of the terms; this criticism shows, experimentally or analy-

tically, that the symbols OH_3, when interpreted into sensibles, do not represent the equivalent of water; whereas OH_2, when interpreted, are found to have this equivalence; and since the *one side of the equation may be used indifferently for the other*, being, in fact, the other differently expressed, we say the proposition is an identical one, and is therefore true. Whether the symbol OH_2 or the symbol "Water" be employed is indifferent; whatever can be said of the one may be said of the other. The proposition, Water is OH_2, is general; the proposition, Louis Napoleon was a perjurer when he violated his oath on the 2d December, is particular; and although it is a proposition reducible to the identical one that men who violate their oaths violate them, there is an assumption that Louis Napoleon did violate his oath, which if granted, or proved, carries the conclusion.

57. The Twofold Aspect which Nature presents to us in the real and ideal world, the actual world given in Perception, and the transfigured world symbolised in Conception, has been already explained. It is obvious that on this view there must be truths of two orders—truths of Perception and truths of Conception; that is, truths which express the equivalences of reals, and truths which express the equivalences of symbols. The truths of Geometry, or indeed of Science generally, must be absolute when they are equations of signs and their significates; but they cannot be more than approximations to the truth of reals; and indeed before they can be held to be true of reals at all, they must be reduced from symbols to feelings (§ 46). We sometimes hear that they are only truths of Definition—propositions about the meaning of words. This is so; for they are only symbolical equations. And this is a point

clearly to be apprehended, since almost every dispute ultimately turns upon the interpretation of the symbols. But inasmuch as our symbols are always supposed to stand for realities, unless the contrary be distinctly stated, and to stand for them in the way signs stand for their significates, the truths which we establish in exhibiting their equivalences are understood to represent the actual order of phenomena; and whenever experiment shows the actual order not to be in harmony with such representations, we declare there has been some error of interpretation, or some confusion of symbols. The ideal truth *stands for* the real truth, but expresses it in its own ideal forms. The equations of Light, for example, are not in the least *like* what is visible in the phenomena of Light; and any one glancing over a page of mathematical formulæ would be sorely puzzled to divine what possible connection they could have with the physical facts which they condense and symbolise. But the mathematician knows that these symbols stand for accurately-determined relations, and are simply real facts transfigured into ideal facts. Little as we ordinarily suspect it, the verbal symbols in which we express our thoughts about phenomena, the conceptions we have of facts and processes, are not less removed from all resemblance to realities; they too are ideal transfigurations of real perceptions. But note this: the order of combination of symbols, mathematical or verbal, may be logically or grammatically perfect, yet the formula or proposition may be false in its application to reals, *i.e.*, in its interpretation; and this on two grounds: either because the symbols have no real, only ideal, significates; or because the symbols have real significates, but these have not the precise relations here assumed to be

represented. We then say that such propositions are ideally true, really false. When, for example, imaginary quantities appear in the course of calculation, we do not deny these to be truths of calculation; we only deny that there are real quantities of this nature. Again, when we say that a centaur is an animal half man and half horse, this truth of definition is a truth in the poetic region where such animals are feigned as existing, though only children or uncultivated minds would accept it as a real truth.

58. Hence the common idea of Truth as the conformity between Thoughts and Things, the correspondence between Reals and our Conceptions of them, requires to be carefully interpreted. We need not entertain the sceptical position that man, being incapable of knowing things as they are, is necessarily incapable of knowing whether his conceptions conform to things or not. I deny the incapacity; and further, I affirm that the conformity is never more than that of a symbol with the thing symbolised. Hegel truly says that Philosophy "substitutes Thoughts, Categories, or, more precisely, Conceptions, in the place of Perceptions, *Vorstellungen*." (HEGEL: *Encyklopädie*, § 3). The only validity to be claimed for a conception is that it represents experiences; if we can interpret the symbol into real feelings, we then see that the symbol may be used as their equivalent, and we say the conception is conformable with the reality. Mr Shadworth Hodgson well says, "Without thought no truth, without perception no reality. By reality I understand the actual existence of any object, its actual presence in consciousness; this is not greater after thought than before; thought has transformed

it into a different shape, has given it new relations, but has added nothing to its real existence. Truth, on the other hand, is the product of thought, the form which an object assumes after investigation, and thus is greater after thought than before. Reality depends on the relations between objects and consciousness; truth on the relations between objects in consciousness." *

59. The conformity of thought with things is to be thus interpreted as the conformity of signs with their significates. Much discussion goes on because the contending adversaries have different significates for the same signs. Thus, a man in certain fever stages feels cold, declares he is cold, and piles fresh blankets on his shivering limbs. The physician, applying a thermometer, declares that, so far from being cold, the patient is really hotter than usual. Who is right? Most persons would say the physician was right, and would regard the patient's feeling as an illusion, because "not in conformity with fact." Yet, observe, the patient simply declared that he felt colder; *that* was no illusion. Although his feeling might not have been in *conformity with the thermometer*, it was a fact of feeling admitting of no doubt; so when he said that he was cold, this was only another expression of the felt fact. He did not say, "If you apply a thermometer to my tongue, you will find the mercury lower than it was an hour ago." He simply said that he was what he felt. The physician, interpreting the antecedent of this feeling, simply said that it was *not* such a cause as would manifest itself in a fall of the mercury. Both state-

* HODGSON: *Time and Space*, 1865, p. 352.

ments are compatible, both are correct within the limits of their respective terms; and, as we have already stated, no proposition can be true beyond the limits of its terms: an equation is only of the specified values or ratios.

60. The objective value of a proposition lies in the import of its terms, and its application to other cases; hence the inference of the patient is that, feeling colder, he must heap up the blankets; the inference of the physician is that the cause of the cold feeling, being a diminished activity of the surface circulation which cannot be remedied by blankets, a very different remedy must be tried—and perhaps he applies ice to the nape of the patient's neck. Let us suppose this to have succeeded, it would afford no ground for the conclusion that "coldness was to be removed by the application of ice;" but this would be a rational conclusion if he simply inferred that the next patient who was suffering from *this* fever-cold, at *this* stage and under *these* conditions, would be relieved by ice.

61. The point to which attention is solicited is, that all generalisation proceeds on an assumption of similarity in the import of the terms, and all errors, both of conduct and reasoning, result from assuming similarity where, in fact, there is diversity. Mathematical truths, as we saw in the preceding Problem, are only exact, necessary, universal, in virtue of this assumption; mathematical propositions become inexact or contingent whenever they are applied to cases involving conditions *not* included in the terms. It is, for example, mathematically true that if eight white balls and four black balls are shaken up in a bag, the probability of a white being withdrawn is

two to one; and this truth may be universalised, and applied to all objects, to eighty and forty, or to eight million and four million. But how? Only by restricting it to the expression of the numerical relations, *and excluding all diversity in the import of the terms.* For suppose the terms black and white balls include balls of different sizes and surfaces, the *numerical* probability will then be affected by this *physical* difference; the four black balls may be so much larger than the white as to occupy nearly the same space, or their surfaces may be so adhesive that three of them will constitute a group settling at the bottom of the bag; in either case, although the ratio of eight to four is two to one, the probability of drawing a white ball will be less or more than two to one.

62. We see then how Truth, which is correctness of Inference expressed in terms, is the equivalence of import in the terms, the equivalence of the signs and the things signified; and this equivalence is either seen in the intuition of the relations, or felt in the reduction of Inference to Sensation. If I say, $d + b = d - a$, this equation is, or is not, correct, according to the values, arbitrary or real, which the terms express; in like manner, if I say, "The strongest government is the best government," the proposition is a truism or a falsism, according to the import of the terms government, strongest, and best. Now since Ratiocination is distinguished from Feeling in that it deals with symbols, and not with the things symbolised—with ideas which stand as the equivalents of feelings, and these feelings as the equivalents of their objects—this separation of the sign from the thing signified has led to a parallel separation of Formal or Logical Truth

from Real or Material Truth, and again, of Subjective from Objective Truth. Like other artifices, this has its convenience and its danger. Once understand that Truth is simply the equivalence of Inference and Sensation, of Predicate and Subject, or—more generally—of its terms, and the consequence is plain that every proposition which can be reduced, directly or indirectly, to an identical equation, is rigorously true, though only true within the limit of the import of the terms.

63. And how is this equivalence to be ascertained when not directly intuited in the terms? It is by rendering conspicuous the equality which was inconspicuous—the exhibition of the values which *satisfy* the equation. This can be done even in axioms, although most philosophers assume that axioms are indemonstrable. Thus, take the self-evident equation A = A; or, 'whatever is is.' If the A on one side expresses either more or less than the A on the other side,—unless the *is* has the same import in both members,—the equation is not satisfied. Passing from such conspicuous truths, which are only truths because they are identical propositions, to the inconspicuous truth that the square of the hypothenuse is equal to the squares of the sides, this also is transformed into an identical proposition; a transformation which may be effected by a direct appeal to the senses, or by an indirect appeal to them through a geometrical construction. Thus, I may cut a card into the form of a right-angled triangle, and then cut square pieces accurately adapted to its sides; these pieces may then be so dissected that the squares of the two sides will accurately cover the same space as the square of the hypothenuse. Instead of this direct appeal, I may

pursue the indirect appeal of Geometry, dividing into compartments the spaces to be compared, in such a way that the sum of the parts in the one is seen to be exactly equal to the sum of the parts in the other two, and the intuition of this equivalence gives the identical proposition that equals *are* equal.

The truth of a conclusion obviously depends on the import of the premises, since it is *shut up* in them, and is their *expression.* But although a conclusion must be contained in its premises, it may not be conspicuous in their statement. Sometimes it is so evident that a child will see it shining through the terms. Sometimes it is so masked that centuries of effort are required to disengage it. When disengaged, it is seen in the terms; and, if seen, can be shown to others, *demonstrated.*

64. This reduction of Truth to an identical proposition will probably excite some of the impatience so often expressed at the advancement of identical propositions, wrongly called "trifling." Yet when a man propounds a truth, what more does he intend than to express *what the facts are?* and what is a statement of facts more than the assertion *that they are what they are?* I am not denying the difficulty of ascertaining what the facts are; I only say that the truth of the statement, *when* ascertained, is an identical proposition, or may be transformed into one; and the *test* of Truth is precisely this reduction. The pursuit of Truth is the pursuit of Identity amid Diversity. When philosophers investigate phenomena so diverse as those of Light, Heat, and Sound, their purpose is not to find diversities—these are conspicuous—but to find the identity of wave-motion common to them

all; and the equations to which investigation leads are seen to be translatable into identical propositions —that is, propositions in which either of the terms may be used as equivalent to the other.

65. Here it may possibly be asked, How do we distinguish the Certitude of Truth from that of Hallucination on the one hand, and that of Conviction on the other? In abnormal states of the nerve-centres, we have subjective sensations which are not less vivid than the sensations normally produced by objects; and this vividness, by a psychological law, brings with it a belief in the presence of the objective normal cause. Philosophers, too, after intense meditation, and ordinary minds, after long and unquestioning acceptance of ideas, have a conviction which is not to be shaken by argument or evidence. Yet the patient when cured will admit that his hallucination was not a truth; the philosopher on further reflection may admit that his conviction was erroneous; the ordinary man may have his vision of the facts so enlarged that what once seemed indisputable now seems childish. In each case the change is effected by the discovery of a discrepancy between inferences and sensations, the signs and their significates. When my nerve-centres are in an abnormal state, I may see objects and hear voices; the feelings are real, and I interpret them as due to their normal causes—that is, I infer that there are now present certain tangible and movable objects, which I shall be able to touch and move if I approach them. On proceeding to test these inferences I do not find the expected sensations—the visible object cannot be touched, the voice heard proceeds from no discover-

able speaker. In like manner, when I act upon my theory, I do not find the previsions confirmed; or if I fancy them to be confirmed, other men testing the theory in the same way do not. My conviction, then, in both cases, turns out to be a subjective feeling without objective validity—it is mine, and true for me; it is not true for others, therefore cannot be used as knowledge.

No such failure can exist when a conviction is objectively confirmed, and the equivalence of the sign and the thing signified is proved, by the ability to use the one in lieu of the other. The Certitude in that case is absolute. We may doubt whether the terms of a proposition express experiences, whether the symbols of Thought have such representative value that they can be used as the equivalents of Feeling; but we cannot doubt that equivalences are equivalent (that being an identical proposition), and the proposition only *asserts* this equivalence, its demonstration *shows* it.

66. We formerly saw that Perception and Intuition are liable to illusion. (M. Taine has the paradoxical theory that Perception is *une hallucination vraie.*) And the truth of a perception or an intuition can only be verified by Action or Reflection. By acting on the guidance of a perception, we reduce its inferences to sensations. By reflecting on it, we see how it harmonises with other experiences; if these experiences are intuited as those which have formerly been verified, and are therefore taken as true, and if our inferences are intuited as thoroughly consistent with these truths, we see that they also must be true.

We are incessantly translating our sensations into

inferences, our perceptions into conceptions, and re-translating our conceptions into images of perceptions; in this play of Feeling and Thought, this interblending of the real and ideal, there is ample room for Error to slip in unobserved. Our safeguard is Reflection, which discerns the values of our symbols, the inferences connected with our sensations. When Reflection discloses Equivalence, it transforms Conviction into Certitude, subjective Opinion into objective Truth.

67. The Principle of Equivalence, as I prefer to name this test of Truth, in order to get rid of the objections raised against identical propositions, will be found to clear up many obscure questions; and we shall presently apply it * to the difficulty which has often puzzled philosophers who have clearly seen that no conclusion can be more than a specification of what is contained in its premises, and who fail to see how this is reconcilable with the fact that new truths are said to be discovered deductively. Other applications must, however, first engage our attention.

* See PROBLEM III., chap. vi.

CHAPTER IV.

THE CERTAINTY OF TRUTHS.

68. It may seem frivolous to ask whether, having ascertained a truth, we are warranted in proclaiming its absolute certainty? Yet according to most philosophers it is a vital question whether the certainty attainable by man is not purely relative; in other words, whether any truth can be proclaimed absolutely true. The dispute is kept up simply because the disputants shift their positions. Once fix the import of the terms, and a final agreement is possible.

All knowledge is relative to the knowing mind. This is indisputable. In this sense, therefore, all knowledge must be relative. Absolute knowledge, or absolute truth, is a contradiction in terms, unless we mean by it irreversible certainty. That is absolutely true which cannot be otherwise. The only rational statement of the question then, is this: Granting that our knowledge of Things never can transcend sensible relations—never can include the modes of Existence which lie outside these relations—are we not to accept the known relations as certainly true and irreversible, because of unknown relations excluded from our expressions? Obviously our truth has reference only to the relations formulated; and no doubt is thrown

upon an intuition or a demonstration, because it is an intuition or demonstration of one item in the great Whole, not of the great Whole itself. If we can resolve an equation of the first or second degree, this absolute certainty is not disturbed because there are equations of a sixth degree which surpass our powers.

69. It is clearly open to us to attain absolute certainty of relative knowledge; and every identical proposition is an irreversible truth *within the limits of the formulated terms.* History tells plainly enough that the theories with which men have explained the facts observed have been continuously changing, the confidence of yesterday being displaced by the doubt of to-day; and impressed vividly by this spectacle of change, some have given a willing ear to the sceptical conclusion that nothing can be certainly known, one opinion being as true or as false as another. They might with equal justice conclude that the Universe has no reality, because its forms are unceasingly changing. Things are not more stable than theories. Such stability as belongs to either is but that of a moment in the flux of Evolution: *πάντα ῥεῖ.* The acorn *is* an acorn, although it will (under requisite conditions) *become* an oak. The insect is what it is at each stage of its metamorphosis. To deny its reality at any one stage, because of the changes which will occur under changed conditions, is absurd. Equally, though less obviously, absurd is the denial of the truth of a proposition because an enlarged experience may show, or has shown, many facts which that proposition does not include, and which were *not expressed in its terms.* No truth can be overturned. It can only be restricted to a narrower range, when

more facts or more factors of the facts, appear in the field of vision, and thus a larger *import* is given to the terms.

There is a development of Knowledge, as there is a development of the Cosmos. The reader may accept or reject the view of the Cosmos as existing only so far as it is incorporated in Mind; but he must admit that the development of the *known* Cosmos is simply that of our knowledge of it. The confused excitation of sensibility gradually assumes shapes; and objects exist *as* objects of Consciousness when the Chaos passes into a Cosmos: as more and more facts of Feeling are grouped in symbols and in series, the Cosmos becomes intelligible. Thus, the dominant theories of successive epochs in the development of man express the successive stages in the development of our Cosmos. In this sense the early theories were true; they were true as the ideal representations of the real order—at least in so far as they exactly formulated all that had been observed; and false in so far as they excluded facts that were observed, or included facts contradictory of what had been observed.

What men observed of the movements of the heavenly bodies (it was not much) was rightly interpreted by them on the theory of the heavens revolving round the earth at rest. This formula of the facts failed, indeed, to include what afterwards became known; but although it was displaced by the Copernican hypothesis, which allowed the sun to be at rest, and sent the earth and the planets whirling round the sun, this displacement was no more than the displacement of a provisional organ by a new organ (like the branchiæ of the tadpole giving place to the lungs of the frog). It was not an exhibition of

the untruth of the old theory; on the contrary, that formula so far expressed real observations that, even now, in spite of Copernicus, Galileo, Newton, and Laplace, we habitually regard the earth as at rest, and only adopt the enlarged theory for astronomical purposes, when dealing with phenomena which were hardly suspected when the old theory was framed. Nay, even the Copernican hypothesis of the sun being at rest no longer adequately expresses the observed facts, which disclose that the sun is no more at rest than the earth is, but moves with its whole system in the direction of the constellation of Hercules. Nor have we any grounds for supposing even this interpretation to be final: it embodies present knowledge, that is all. To-morrow a new observation, or a new method of analysis, may displace all our astronomical theories.

This advance of knowledge, and restriction of the theories which express our knowledge, is improperly invoked as a justification of Scepticism. Instead of exclaiming, "See how men differ and err! there can be no fixed Truth!" we should note how knowledge widens, and how truths successively express the widening Experience; just as the organism develops, and is at each stage adapted to its conditions of existence. The transformation of theories, like the metamorphoses of organisms, takes place by an incorporation of the new material with the old.

71. Are then all theories true? By no means. Nor are all judgments correct. Errors abound. But the test is final. A false judgment is an inference which sensation irresistibly disproves. A false theory is a formula which the facts contradict. When a man errs in supposing that the moon is larger at the horizon than at the zenith, or that a certain tower is

round, which, seen at a lesser distance, appears square, the error of judgment is that of generalising the terms without at the same time generalising their import, and assuming that a change in the conditions will not bring with it a correlative change in the expressions. If he simply confined himself to the facts, and said, The moon appears larger at the horizon, and, The tower appears round at this distance, he would express identical propositions; and the truths would not be disturbed by the other truths expressing other conditions, when the moon would appear smaller and the tower square. It may be said that these identical propositions are of little use, and that they need the enlightenment of Science to explain on psychological and optical principles how these several appearances are produced. Granted; but you must also grant that without these despised identical propositions Science could not stir a step in explanation.

72. There are truths of various orders, but not of various degrees of certainty. The Law of Multiple Proportions in Chemistry is the abstract expression of observed facts, and as such, is an unshakable truth, even though conceivably some wider Law may include it. The Atomic Theory which interprets the phenomena is a true theory, although based on the hypothesis of Atoms, which cannot be proved, and may some day be dismissed to give place to a better. The Undulatory Theory is true, though the hypothesis of an Ether is possibly doomed to disappear. I mean that the theories are true because they are formulas of facts; that gases consist of separate particles nearly alike, and that in radiants there is periodic motion, are propositions logically equivalent to the experi-

ments; the hypotheses, which are introduced as auxiliaries, may be replaced by better auxiliaries, but there can be no displacement of the experimental facts.

73. The Evolution hypothesis, to which Mr Darwin has given the name of Natural Selection, is offered in aid of interpreting the observed facts of community of structure and function. The Creation hypothesis, by which naturalists of the opposing school interpret the same facts, is gradually being displaced, as it is now more and more recognised to belong to the class which I have named Illusory Hypotheses.* The observed facts are, that all plants and animals have certain characters in common, and certain differences, these resemblances and differences forming the conceptions Organism, Plant, Animal, Genera, Species, &c. Further, it is observed that some groups are widely separated from others. What is called the fixity of species expresses this observation. So long as the question is purely zoological, and relates to the facts observed and observable, there is no dispute. But when Zoogeny replaces Zoology, and the question of origin is mooted, the two hypotheses of Creation and Natural Selection struggle for supremacy. The advocate of Creation, throwing the predominant weight of evidence on the observation of Difference and the fixity of types, assumes that these types were constructed once for all, each in its observed position,

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able speaker. In like manner, when I act upon my theory, I do not find the previsions confirmed; or if I fancy them to be confirmed, other men testing the theory in the same way do not. My conviction, then, in both cases, turns out to be a subjective feeling without objective validity—it is mine, and true for me; it is not true for others, therefore cannot be used as knowledge.

No such failure can exist when a conviction is objectively confirmed, and the equivalence of the sign and the thing signified is proved, by the ability to use the one in lieu of the other. The Certitude in that case is absolute. We may doubt whether the terms of a proposition express experiences, whether the symbols of Thought have such representative value that they can be used as the equivalents of Feeling; but we cannot doubt that equivalences are equivalent (that being an identical proposition), and the proposition only *asserts* this equivalence, its demonstration *shows* it.

66. We formerly saw that Perception and Intuition are liable to illusion. (M. Taine has the paradoxical theory that Perception is *une hallucination vraie.*) And the truth of a perception or an intuition can only be verified by Action or Reflection. By acting on the guidance of a perception, we reduce its inferences to sensations. By reflecting on it, we see how it harmonises with other experiences; if these experiences are intuited as those which have formerly been verified, and are therefore taken as true, and if our inferences are intuited as thoroughly consistent with these truths, we see that they also must be true.

We are incessantly translating our sensations into

inferences, our perceptions into conceptions, and re-translating our conceptions into images of perceptions; in this play of Feeling and Thought, this interblending of the real and ideal, there is ample room for Error to slip in unobserved. Our safeguard is Reflection, which discerns the values of our symbols, the inferences connected with our sensations. When Reflection discloses Equivalence, it transforms Conviction into Certitude, subjective Opinion into objective Truth.

67. The Principle of Equivalence, as I prefer to name this test of Truth, in order to get rid of the objections raised against identical propositions, will be found to clear up many obscure questions; and we shall presently apply it * to the difficulty which has often puzzled philosophers who have clearly seen that no conclusion can be more than a specification of what is contained in its premises, and who fail to see how this is reconcilable with the fact that new truths are said to be discovered deductively. Other applications must, however, first engage our attention.

* See PROBLEM III., chap. vi.

each without reference to the other, as palaces, public-houses, villas and cottages, are erected by men. The other school, admitting all that is really *observed* in respect to fixity of type, but denying what is *inferred* in respect to the impossibility of each type arising by infinite infinitesimal increments of variation, assumes that the *observed* facts of variation point to the evolution of all forms from pre-existing forms, and ultimately, of all from one.

Both these hypotheses of origin must always remain hypotheses. Knowledge of what things are under observed conditions may be absolute; it can never lead to more than hypothetical statements of what things were under other conditions; and since it is manifestly impossible that we should ever know what were the exact conditions under which organic life emerged, we can do no more than guess at origins. The guesses will have more or less probability in proportion to the ascertained facts on which they rest. When, for example, it is proved that individual organisms vary, the proof is inductively furnished that species vary, since species are but groups of individuals. This, however, does not disturb the truth that the specific *type* cannot vary; for the type is an abstraction, and the very terms in which it is expressed exclude variation. The type is what it is; the individual is also what it is. The type is ideal; the individual is real.

74. I have repeatedly insisted on the memorable fact that Science is no transcript of Reality, but an ideal construction framed out of the analysis of the complex phenomena given synthetically in Feeling, and expressed in abstractions. In all analysis there

is abstraction, which rejects much more than is expressed; this rejected remainder may in turn be analysed, but at each step there is an unexplored remainder. As, in the speculation of Laplace, there are dark stars scattered through space, but hidden from observation because they are dark; so in every phenomenon there are numberless factors at work which are hidden from observation, and only speculatively postulated. Sometimes these speculative inferences, which always have some basis in observation or analogy, suggest the means of objective verification. Thus, Newton inferred that bodies at the earth's surface gravitated towards each other; it was an inference from analogy, but was then beyond experimental proof.* It has since been experimentally verified, and thus exhibited not only as an ideal truth, but one having real application.

75. It is requisite to bear in mind that no general statement can be real, no ideal truth be a transcript of the actual order in its real complexity. "Until we know thoroughly the nature of matter, and the forces which produce its motions, it will be utterly impossible to submit to mathematical reasoning the *exact* conditions of any physical question," † and even then it will only be mathematical relations which will be formulated. The approximate solutions which are reached "are obtained by a species of abstraction, or rather *limitation of the data*," and thus "the infinite series of forces really acting may be left out of consideration; so that the mathematical investigation deals with a finite

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(and generally small) number of forces, instead of a practically infinite number."*

If, then, Science is, in its nature, an ideal construction, and its truths are only truths of symbols which approximate to realities, there is an internal necessity of movement in scientific thought, which transforms existing theories according to ever-widening experience. We can never reach the finality of Existence, for we are always having fresh experiences, and fresh theories to express them. We also need hypotheses to supplement the deficiencies of observation; and that hypothesis is the best which introduces most congruity among our ascertained truths. Yet throughout this shifting of the limits there is a constant principle of Certitude, and the truth of yesterday is not proved false because it is included in the wider truth of to-day; the two truths express two limits of Experience.

76. In conclusion, we may say that various theories are ideal representations of the External Order, and are severally *true*, in so far as the import of their terms includes no more than has been verified by the reduction of Inference to Intuition or Sensation; severally *false*, in so far as their terms include what is inconsistent with such verified import; and severally *doubtful*, in so far as the terms include what has not been thus verified. To express it in a more abstract phrase: Truth is the equivalence of the terms of a proposition; and the equivalence is tested by the reduction of the terms to an identical proposition.†

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† In the Appendix will be found an attempt to apply this result to an examination of the axioms of Geometry, usually accepted as embodying truths of the highest order of exactness. If we find the test applicable there, we may the more readily admit its applicability in other sciences. See Appendix, A.

CHAPTER V.

THE LOGICAL PRINCIPLES.

77. THE Principle of Equivalence, which has been expounded in the preceding pages, is free from the ambiguities which have caused many philosophers to reject the three scholastic principles, Identity, Contradiction, and the Excluded Middle. It is, moreover, the positive statement of the negative formula advanced by Mr Herbert Spencer, as the Universal Postulate, or the inconceivableness of the contrary of a proposition. This formula has been much criticised, and much misunderstood. In the republication of his *Principles of Psychology*, Mr Spencer has given a re-statement of his views, freeing them from some ambiguities of expression. Thus, in place of the much-criticised phrase, "Beliefs which invariably exist," he proposes, "Cognitions of which the predicates invariably exist along with their subjects." His position may be thus stated: whenever a subject and predicate can be united in the same intuition, the proposition is thinkable: it may be true, or not true; at any rate, it admits of being presented to the mind. Whenever a subject and predicate not only *can* be thus united, but *must* be, the one term being incapable of appearing to thought without the other, the proposi-

more facts, or more factors of the facts, appear in the field of vision, and thus a larger *import* is given to the terms.

70. There is a development of Knowledge, as there is a development of the Cosmos. The reader may accept or reject the view of the Cosmos as existing only so far as it is incorporated in Mind; but he must admit that the development of the *known* Cosmos is simply that of our knowledge of it. The confused excitation of sensibility gradually assumes shapes; and objects exist *as* objects of Consciousness when the Chaos passes into a Cosmos: as more and more facts of Feeling are grouped in symbols and in series, the Cosmos becomes intelligible. Thus, the dominant theories of successive epochs in the development of man express the successive stages in the development of our Cosmos. In this sense the early theories were true; they were true as the ideal representations of the real order—at least in so far as they exactly formulated all that had been observed; and false in so far as they excluded facts that were observed, or included facts contradictory of what had been observed.

What men observed of the movements of the heavenly bodies (it was not much) was rightly interpreted by them on the theory of the heavens revolving round the earth at rest. This formula of the facts failed, indeed, to include what afterwards became known; but although it was displaced by the Copernican hypothesis, which allowed the sun to be at rest, and sent the earth and the planets whirling round the sun, this displacement was no more than the displacement of a provisional organ by a new organ (like the branchiæ of the tadpole giving place to the lungs of the frog). It was not an exhibition of

the untruth of the old theory; on the contrary, that formula so far expressed real observations that, even now, in spite of Copernicus, Galileo, Newton, and Laplace, we habitually regard the earth as at rest, and only adopt the enlarged theory for astronomical purposes, when dealing with phenomena which were hardly suspected when the old theory was framed. Nay, even the Copernican hypothesis of the sun being at rest no longer adequately expresses the observed facts, which disclose that the sun is no more at rest than the earth is, but moves with its whole system in the direction of the constellation of Hercules. Nor have we any grounds for supposing even this interpretation to be final: it embodies present knowledge, that is all. To-morrow a new observation, or a new method of analysis, may displace all our astronomical theories.

This advance of knowledge, and restriction of the theories which express our knowledge, is improperly invoked as a justification of Scepticism. Instead of exclaiming, "See how men differ and err! there can be no fixed Truth!" we should note how knowledge widens, and how truths successively express the widening Experience; just as the organism develops, and is at each stage adapted to its conditions of existence. The transformation of theories, like the metamorphoses of organisms, takes place by an incorporation of the new material with the old.

71. Are then all theories true? By no means. Nor are all judgments correct. Errors abound. But the test is final. A false judgment is an inference which sensation irresistibly disproves. A false theory is a formula which the facts contradict. When a man errs in supposing that the moon is larger at the horizon than at the zenith, or that a certain tower is

round, which, seen at a lesser distance, appears square, the error of judgment is that of generalising the terms without at the same time generalising their import, and assuming that a change in the conditions will not bring with it a correlative change in the expressions. If he simply confined himself to the facts, and said, The moon appears larger at the horizon, and, The tower appears round at this distance, he would express identical propositions; and the truths would not be disturbed by the other truths expressing other conditions, when the moon would appear smaller and the tower square. It may be said that these identical propositions are of little use, and that they need the enlightenment of Science to explain on psychological and optical principles how these several appearances are produced. Granted; but you must also grant that without these despised identical propositions Science could not stir a step in explanation.

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tion is necessary; and its negative being unthinkable, the proposition itself must be true.

78. I do not quite go along with Mr Spencer when he argues for the necessity of some *unproved truth*, as a fundamental postulate; on the contrary, it seems to me that every proved truth is ultimate, requires no foundation, admits of none, though it may receive a logical justification by being thrown into the form of an identical proposition. The finality is Feeling, and a truth of Feeling needs no external support. The same is to be said when the truth of Feeling is expressed in Signs. Mr Spencer's demand for some unattainable depth to be postulated, but not plumb-lined, may be compared with Hegel's position that Truth is always infinite, and cannot be expressed in finite terms. But leaving this and one or two minor points out of consideration, I think his arguments are conclusive, and only prefer the proposed formula of Equivalence because it is positive and unambiguous. It simply says, that equation is true the terms of which have the same value; that inference is true which can be used as the equivalent of the actual sensation; that conception is true which expresses in a condensed form all—and no more than—the perceptions experienced; that proposition is true of which the premises and conclusion are equivalents, the one being capable of replacing the other, since the one is but the obverse aspect of the other.

Mr Mill and Professor Bain reject Mr Spencer's principle, and propose to substitute for it the assumption of the Uniformity of Nature. There is a sense in which this is precisely tantamount to the Principle of Equivalence, and in this sense it is acceptable; but

one must also admit that the formula is very ambiguous, and in some interpretations frequently adopted is demonstrably erroneous. I will touch on it after saying a word on each of the scholastic principles.

THE PRINCIPLE OF IDENTITY.

79. This has been severely criticised, especially by those who treat it as if it were put forward as a guide, whereas it is obviously not a guide, but a test; not an instrument of search, but a criterion that what is found is correctly expressed. To assert that 'A is A,' or 'A=A', or that 'whatever is is,' can indeed be but a feeble help when the whole stress is directed to *what* is? Such an assertion is simple tautology. Condillac, who makes all reasoning consist in the translation of identical propositions, distinguishes between propositions which are frivolous, because their identity is that of terms, and propositions which are fruitful, because their identity is that of ideas. To say 'six is six' teaches nothing, it is mere iteration; but to say 'three and three equal six' enlarges knowledge, by disclosing identity of ideas under diversity of terms. When we judge two men to be of equal size, we see one thing in the two things compared, that is to say, one size in two men, and we form an identical proposition.*

Although this is not expressed with exactness, the meaning is accurate enough. It is misleading to say that the *ideas* of three and three, and of six, are the same; but we can say that the two groups are numerically equivalent. All knowledge begins with the discernment of resemblances and differences—it is

* CONDILLAC: *Langue des Calculs*, p. 64.

necessarily polar, resemblance being impossible except on a background of difference, and difference also impossible except on a background of resemblance. While knowledge begins here, it ends with equations. What are equations? The *resemblances* abstracted from all *accompanying differences*, and reduced to the *identity of equivalence*. At first no one sees that $2+1$ is identical with $4-1$. Nor indeed, strictly speaking, is it so. The numbers are not the same, the operations are not the same; but the result of the operations is the same, and the terms in these operations are therefore equivalent: for when we perform the operation $2+1$, we get 3 as the result; and when we perform the operation $4-1$ we also get 3: and it is an identical proposition to say $3 = 3$.

80. If we say 'Man is Man,' the proposition is infertile, because the identity is simply affirmed, it is not disclosed *amid diversity:* it is tautology, not equivalence—the statement of one fact, not of two aspects of one fact. But although infertile, the proposition is irresistible. If we vary the terms, and introduce diversity into the proposition—*e.g.*, 'Man is a vertebrate animal'—it becomes instructive by the statement of an equivalence, which may possibly be erroneous; but when clearly exhibited, and when some of the constituent elements of the class Man are shown to be equivalent to the constituent elements of the class Vertebrate Animal, it has absolute certainty; for the equivalence includes identity. It is an equivalent proposition, that if a force of 7 units produces a velocity of 3 feet a second, a force of 21 units will produce a velocity of 9 feet a second: here the forces and spaces are different, but their ratios are equivalent, the ratio

of 7 to 21 being $\frac{1}{3}$, and the ratio of 3 to 9 being $\frac{1}{3}$; hence the equation is the identical proposition $3 = 3$.

81. On the other hand, observe that the fertile principle, the instructive axiom, is not that of Identity, as tautology, but that of equivalence of the different terms—not the assertion, *le même est le même* (Condillac), but the assertion that the different aspects have equivalent values. A ton of coals is not the same as 20 cwt. of stones; but amid the various relations which are grouped in the coal and the stone, some are the same, *i.e.*, of equal value; and this one relation of tending towards the earth's centre is the same in both. That a ton equals a ton, is an identical proposition; that the weight of a ton of coals equals the weight of 20 cwt. of stones, is an equivalent proposition. A message in cypher, and a message in the ordinary symbols of writing, have the same thought differently expressed; but the art of detecting this identity amid such diversity is the art which enlarges knowledge. Expressions which are identical are also equivalent, but the converse does not hold. Thus, $\frac{a^3 - x^3}{a - x}$ is equivalent to $a^2 + ax + x^2$, but the expressions and operations are by no means the same.

Science has already reached the sublime height of contemplation from which all the manifold and complex phenomena are regarded as modifications of each other, capable of substitution—different expressions of equivalent relations, different combinations of *invariant values*. All phenomenal changes are changes of Quantity—redistributions of unchanging dynamical units—*metamorphoses*, and not (as commonly con-

ceived) *metempsychoses*, in which one thing is supposed to inhabit another.

THE PRINCIPLES OF SUFFICIENT REASON AND CONTRADICTION.

82. We may now pass from the famous Principle of Identity to consider two other principles also invoked by logicians, and to show how they fall under that of Equivalence.

"Nos raisonnements," says Leibnitz, "sont fondés sur deux grands principes, celui de la contradiction, en vertu duquel nous jugeons faux ce qui en enveloppe, et vrai ce qui est opposé ou contradictoire au faux; et celui de *la raison suffisante*, en vertu duquel nous considérons qu'aucun fait ne saurait se trouver vrai ou existant sans qu'il y ait une raison suffisante pourquoi il en soit ainsi et non pas autrement, quoique ces raisons le plus souvent ne puissent point nous être connues." * The last-named principle has been ridiculed, mainly because of the misleading connotations of the word *reason*; but if instead of *reasons* Leibnitz had used the term *ratios* or equivalent values, it would have expressed what we have formulated as the Principle of Equivalence.

83. And what place can we assign to the Principle of Contradiction? Is it simply the correlative form of the Principle of Equivalence—the negative of that affirmative? or is it a new principle, having another reach? It is obviously the former. Affirmation and Negation are the inseparable poles. True is the positive affirmation, False is the negative affirmation, of the same proposition. And since no proposition can be at once true

* LEIBNITZ: *Monadologie*, §§ 31, 32.

and false while its terms remain the same, but must be either true or false, under alternative aspects, the Principle of the Excluded Middle, which is simply the assertion of such an alternative, is seen to be nothing more than the Principle of Equivalence.

84. Although it is an identical proposition when we say 'A is A,' and 'A is *not* non-A,' there are often advantages in employing the negative form: one advantage being that of enabling us to indicate indefinite negation. Since all Sensation is a grouping, all Perception a grouping, all Judgment a grouping, and since a grouping is necessarily both an Inclusion and an Exclusion, there is a latent Not involved in every affirmation. "This is blue" cannot be said nor thought without its involving the unexpressed affirmation, "This is not red, nor green, nor any colour except blue." Spinoza's celebrated formula, '*Omnis determinatio est negatio*,' might perhaps be less ambiguous if it were '*Omnis determinatio est separatio*,' and for this reason: the act of cognition is not primarily a negation, but a separation—the inclusion of elements into a group, which by its very limitation is an exclusion of all other elements. This has been well put by the Spanish philosopher Serrano,* and may be thus exemplified: the colour blue, when felt or thought, has for its physical basis a definite group of neural units, which group is thereby separated from *all* other groups of neural units, whether forming other colours, or any other sensations. This definite group, sepa-

* 'Pudiera creerse á primera vista que la negacion se limitaba á anular el concepto negado; pero mirándolo mejor, se echa de ver que, así como la afirmacion *niega* lo contrario de lo que afirma, la negacion *afirma* lo contrario de lo que niega.'—NIETO SERRANO: *Bosquejo de la Ciencia Viviente*, 1867, p. 92.

rated from the not defined other groups, is a positive, and like every positive, has its correlative negation. But the group itself was formed by separation and inclusion. In fact, although negation is necessarily involved in the affirmation, it is only in the Logic of Signs that the negation holds an equal position; in the Logic of Feeling every negation is obscure. As Kant remarks, to perceive a difference is one thing, to know a difference is another. The dog distinguishes meat from bread without knowing that the one is not the other: his perception of the difference determines different actions; and for this it is only requisite that the perceptions should be connected with different actions, it is not necessary that a judgment should have determined the actions.*

MR BAIN'S POSTULATES.

85. In lieu of Mr Spencer's Postulate, the "Unthinkableness of the negative," Mr Bain, in his *Logic*, proposes two postulates: these are, first, the postulate of Consistency, or Self-Consistency, the absence of contradiction; secondly, the postulate of Nature's Uniformity. To a great extent the first harmonises with our Principle of Equivalence, and includes Identity, Contradiction, and Excluded Middle. But because, according to Mr Bain, this cannot guarantee Induction, he further postulates three guarantees of Experience, which are, 1°, trust in present consciousness; 2°, trust in Memory; 3°, trust in the future.

* KANT: *Unters. über die Deutlichkeit der Grundsätze. Werke*, i. 76. Compare also an earlier page of the same volume, p. 17. I do not agree with this view of Judgment, unless it be understood as confined to the Logic of Signs; but of this we shall discourse in the next PROBLEM.

Mr Bain is one of the most powerful advocates of the Experiential Philosophy; it is therefore incumbent on me to scrutinise with great minuteness any position deliberately adopted by him respecting the foundations of Certitude. In the present case, we must first consider the basis on which he builds. "Demonstration," he says,* "is the referring of a fact to a higher generality already established; to demonstrate such higher generality would be to find some principle still more general; a few steps would lead us to something that is absolutely final, something whose evidence is not demonstrable, and something believed in without extraneous support." In the chapter on Demonstration (vol. i. p. 368), I argued that the "final something" was the reduction of Inference to Sensation, and that Feeling requires no extraneous evidence—it is its own evidence. But the excessive caution of Mr Bain leads him to doubt whether what is irresistibly certain may not be possibly erroneous, and to propose in lieu of this irrefragable principle two postulates, one of which he admits may be erroneous, though it is practically relied on, and the other as a guarantee and ultimate major premiss of Induction, which also may be erroneous. To call the irresistible certainty of Feeling an "assumption" is pushing Scepticism to extremity. Mr Bain says, "We must assume that we feel what we feel. Whether or not we call this an irresistible belief whose opposite is inconceivable, we *assume* it, and proceed to act upon it in all we do." Surely this use of the word assumption is unjustifiable, connoting as it does a possible element of uncertainty? In the fact of Feel-

* *Logic*, i. 266.

ing there is no inference, no assumption; and when this is raised into the Logic of Signs, and finds expression in the identical proposition "whatever is, is," there can also be no inference, no assumption.

86. Let us see how it fares with his three postulates of Experience. The trust in present consciousness surely needs no guarantee, although one may be required for any inference connected with present consciousness. Our trust in Memory is guaranteed under the same conditions. Memory is reinstated Feeling, and, in so far as Inference is mingled with the Feeling, there is the uncertainty attaching to all Inference, which uncertainty is reducible to certainty by the reduction of the inferences to corresponding sensations. It is the same with the future. I cannot be sure that the future will resemble the past, unless I limit my inference to the exact reproduction of the past conditions. Every proposition which can thus be enounced under the form of Equivalence is irresistible; every other is doubtful. What has been will be, under identical conditions. It is this, and this alone, which is the guide and guarantee of Experience. By it we may take what Mr Bain calls "the perilous leap into the future;" that leap which requires, according to him, the postulate of Nature's uniformity. In so far as this postulate expresses the same condition as that of the Principle of Equivalence, it is the postulate of all Induction and all Deduction; but there seems to me an unnecessary ambiguity in Mr Bain's presentation. "The postulate we are in quest of," he remarks, "must carry us across the gulf from the experienced known, either present or remembered, to the unexperienced and unknown—must perform the leap of

real inference. 'Water has quenched our thirst in the past;' by what assumption do we affirm that the same will happen in the future? Experience does not teach this; experience is only of what has actually been; and after never so many repetitions of a thing, there still remains the peril of venturing upon the untrodden land of future possibility. The fact, generally expressed as Nature's uniformity, is the guarantee, the ultimate major premiss of all Induction. 'What has been will be,' justifies the inference that water will assuage thirst in after times. We can give no reason, no evidence for this uniformity; and, therefore, the course seems to be to adopt this as the finishing postulate."*

87. Instead of affirming that we can give no reason for our reliance on this premiss, when properly limited, it seems to me that we have irrefragable reasons for it. The expression of Nature's uniformity is not that on all future occasions the phenomena now observed will be exactly repeated: this is the rash inference of unreflecting minds, which disregards the real principle of uniformity, and supposes it to be independent of conditions. The true expression is the assertion of identity under identical conditions: whatever is, *is*, and *will be*, so long as the conditions are *unchanged*; and *this* is not an assumption, but an identical proposition. There is indeed an assumption of homogeneity underlying all Induction; and when we assume that water will assuage our thirst on all future occasions, it is because we presuppose that the water will be the same or similar, and the thirsting organism the same or similar. If the water be sea-water, or if the drinker

* *Logic*, i. 273.

be in high fever, the introduction of such differences in the conditions necessarily produces a different result. When we affirm that *the same* will happen in the future as in the past, there is no assumption; it is simply the assertion that what occurred was necessitated by its conditions, which is an identical proposition; but when we affirm that our experience will be exactly repeated, there is an assumption, which may be wrong.

88. If Nature's uniformity be taken simply as an expression of the identical propositions "whatever is, is, and will be so long as its generating conditions are unchanged," it is the ultimate logical ground of Certainty. In any other sense it is open to question, and unless limited to the region of Abstraction it is not even true. The appearances of Nature are assuredly not uniform, but multiform; and it is only by abstracting their resemblances from their differences that we are led to assign uniformity. And if we say the appearances are uniform under uniformity of condition, this is simply the identical proposition "the same is the same."

89. I pause here to call attention to the foundation of the Logic of Signs in the Logic of Feeling, and to the fact that all our reliance rests on Desire, *i.e.*, the revival of some previous condition in the organism by a repetition of the former stimulus, or one like it. Had it not been for such Desire or Revival, no act would have been repeated by animal or man, except as a matter of sheer accident; but the Desire for a renewal of the gratification revives the movements necessary for that gratification. When this Logic of Feeling, by which one group is connected with another, is

raised into the Logic of Signs, as in the mind of man, the two groups receive expression in a formula or judgment. The test of the Logic of Feeling is when what is *inferred* is *proved* by reduction of the inference to sensation; the test of the Logic of Signs is when what is inferred is proved by reduction to an identical proposition.

90. The ancients have been ridiculed for including Chance among the agents of Change; and it is undeniable that they often attached erroneous ideas to this agency. Yet Aristotle saw clearly enough that Chance was only a name for our ignorance of Cause; and could he or any other potent thinker of ancient times reappear, and listen to some discussions in our Academies, it is probable that he would be struck with the erroneous ideas now prevalent respecting Law. He would perhaps see that the conception, Law, was as much a realised abstraction as Chance; and might urge that Chance has the same claim to the position of a real agent as Law. Chance is a term by which we express the irregularities in phenomena, disregarding their uniformities; Law is a term by which we classify changes and express the uniformities in phenomena, disregarding their irregularities.* The phenomena themselves are uniform, in the sense of each being always what it is; they are irregular,

* "Tous les événemens, ceux mêmes qui par leur petitesse semblent ne pas tenir aux grandes lois de la nature, en sont une suite aussi nécessaire que les révolutions du soleil. Dans l'ignorance des liens qui les unissent au système entier de l'univers on les fait dépendre des causes finales, ou du hasard, suivant qu'ils arrivaient et se succédaient avec régularité ou sans ordre apparent. Mais ces causes imaginaires ont été successivement reculées avec les bornes de nos connaissances, et disparaissent entièrement devant la saine philosophie, qui ne voit en elles que l'expression de l'ignorance où nous sommes des véritables causes."—LAPLACE: *Essai philosophique sur les Probabilités*, p. 2.

in the sense of being conjoined now in one way and now in another.

91. When Philosophy first began to meditate on the various phenomena which incessantly presented themselves, it obeyed the identifying instinct which groups together resemblances, and gradually ranged these into separate classes. Objects were observed, and classified, according to their resemblances, in genera and species; changes were also observed, and classified in laws of Nature. A general conception of Order emerged in this separation of the like from the unlike. This conception rapidly became extended, owing to that tendency of the mind noted by Bacon,* according to which an uniformity observed soon becomes generalised. Simplicity is so gratifying to the mind, that we are impatient of all perturbations, and huddle them out of sight, inclining to believe that whatever is simple must be truer than what is not. This leads to many precipitate judgments which Experience refutes. For example, nothing can be simpler than the law which declares that acids combine definitely with bases to form salts, and in these combinations the properties of the substances are mutually neutralised. What says Experiment? It says that the combination of an acid with a base does not uniformly, invariably result in this neutralisation: sometimes (in what are called the acid salts) the acid properties continue to be manifest; sometimes (in the basic salts) the alkaline properties

* "Intellectus humanus ex proprietate sua facile supponit majorem ordinem et æqualitatem in rebus quam invenit; et cum multa sint in natura monodica [monadica] et plena imparitatis tamen affingit parallela et correspondentia et relativa quæ non sunt."—BACON: *Novum Organum*, Aph. 45.

appear. It says, moreover, that oxides, and even oxides of the same metal, combine with each other, and that acids sometimes combine with neutral substances (*e.g.*, sulphuric acid with chloride of sodium), or neutral substances with each other. It also says that the same substance will act as an acid in one combination, and as a base in another. Thus, simple the law of combination may be, and true as an abstraction, yet the concrete phenomena present so many diversities as to suggest that the law itself is only an incompletely stated case of some more general law of combination. In a word, the distinction between acids and alkalies vanishes on a close analysis; the terms appear only as the two extremes of a series in which the intermediate terms participate more or less in the general characters of acid and alkali by analogy of composition or properties, without, however, possessing the specially distinctive characters of either; just as the different colours we distinguish in the impure spectrum, such as a rainbow, really contain the vibrations of all orders, but in different proportions, the red containing a maximum of red vibrations with a minimum of violet, and so on.

92. The generalisation that *all* phenomena are regulated by Law requires interpretation. We are not to suppose that Law is an objective real acting in phenomena; it is the ideal conception of the phenomena themselves, classified according to their resemblances with other phenomena. The Law of Nature has no more a concrete existence, apart from the changes in the relations of phenomena, than a Genus exists apart from the individuals it comprises. Hence Law means (in mathematical phrase) the func-

tion of the phenomena; and the generalisation that Chance (*i.e.*, the emancipation of phenomena from Causality) has no place in the system of things is simply the obverse of the previous generalisation. So far all is clear; but now observe the consequence. If all events have their law, each event has its law, namely, that under like conditions it will be invariable; and if the events in Nature are complicated and changeable, what is called the simplicity and uniformity of Nature *is not what exists and is observed*, but what is *constructed in Abstraction, letting drop the observed complexities and irregularities.* The invariability we find in Nature is what we have put there. Thus a body moved by various impulses, and by several velocities, will describe a curve which geometers show might equally well be described under the action of the single resultant force. Because this curve has a simple expression, we might, without further knowledge, regard the law as simple; yet it is obviously complex.

CHAPTER VI.

THE LAW OF INVARIANTS.*

93. We have reached the ultimate logical principle which is the expression of the test of Certitude. But the principle of Equivalence (in the terms equated) has only a *logical* or subjective aspect; we must now see it in its correlative real or objective aspect, as a *cosmical* law.

A moment's consideration will disclose that facts or events are either the *sums* of their units or the *products* of their factors. The difference between an aggregate and a product is that, in the first case the *component parts* are simply grouped together, added; in the second, the *constituent elements* are blended, multiplied into each other. (Compare Rule IX.) But in every case the phenomenon is what it is in virtue of its *determinants*. These determinants (causes, conditions) are quantitatively and qualitatively invariant—the same values always co-operating to produce the same result. There must be variable elements for varying phenomena; but each phenomenon in itself, within its own limit, is necessarily the *resultant* or

* This term *Invariant* has no reference to the speculations of a distinguished modern school of mathematicians. It is here used instead of *Invariable* to avoid many misconceptions.

the *emergent* * of units and factors that are invariant. Thus the number 10, for instance, may be formed by the addition of 5 to 5, of 3 to 7, of 3 to 5 and 2, of 8 to 2, of 6 to 3 and 1—so many variable elements, each of which is however constituted by invariants, and the sum or product of invariants must likewise be invariant. In Dynamics two forces are identical when, acting for the same time, they move the same mass with the same velocity in the same direction, although these forces may be different in their proximate origin and accompaniments—the one being a muscular contraction, the other the expansion of an elastic fluid, a third the impulse of a solid. But however variable the visible antecedents may be, the real determinants—the co-operant factors—are in each case invariant.

94. Here, in passing, note the common fallacy of ascribing the same effect to different causes. (Compare RULE VI. and PROBLEM V. chap. iii.) A close consideration will show that the same effect is everywhere produced, and is only producible, by the same cause, since the product can express only its factors. The attendant circumstances, which perhaps mask the real determinants, lie outside the causal relation; they are not *co-operant* factors. The weight of a body, for instance, is not determined by its colour, form, temperature, &c., but by the quantity, or density, of its molecules, and its relative position in space. Starch, again, is converted into glucose by one cause, and one only, though this determinant may be obtained by a *cortège* of circumstances which are not conditions of the result,

* On the distinction between resultant and emergent, see PROBLEM V. § 63.

but mere camp-followers, taking no active part in the struggle. Chemists call this determinant the hydratation of starch, that is, the fixing in the starch of one equivalent of water, OH_2. This fixing may be brought about in various ways—by heat, vegetable diastase, acidulated water, &c.; and if we regard—and usually we do regard—these agents as the causes, it will be true to say that different causes have here produced the same effect. But this is the popular explanation. Science recognises the causation as effected by the one determinant, always the same.

95. Take two such widely different substances as Formic Acid, a corrosive fluid, and Capric Acid, an oil. They are both constituted by the elements Carbon, Hydrogen, and Oxygen. They agree in having the same units of Oxygen O^4; and both, by this Oxygen, redden vegetable blues. They differ greatly in their other units; the first being C^2H^2, the second $C^{20}H^{20}$—that is, ten times the values of the first; and it is to these differences in the units that must be ascribed the differences in the effects producible by these acids. Again, experiment has shown that all the salts of the same base produce analogous effects on the blood, and it requires "only a more extended series of experiments with the same substances to discover the law that physiological action is connected with their isomorphous relations."*

But even greater is the apparent diversity in the things which produce the same physiological effect. Claude Bernard has shown that many mineral, vege-

* Dr Blake in the *Journal of Anatomy and Physiology*, May 1871, p. 248. See also Frazer and Crum-Brown in recent vols. of the *Trans. R. S. Edin.*

table, and animal poisons having apparently little in common produce the same effect on the muscle as heat. "Un animal empoisonné par l'une quelconque de ces substances parait présenter toujours le même élément histologique atteint, le même cortège de symptômes et les mêmes altérations cadavériques que nous avons vues produits par la chaleur." * Hitherto the determinant has not been found; but who can doubt that, when found, it will be the same in all these things? who can doubt that the variable degrees of its effects will depend on the varying quantities that are operant? who can doubt that these quantities will be invariant for each degree?

96. Every variation, however slight, in any one of the factors necessarily determines a corresponding, though perhaps inappreciable, variation in the product. Otherwise there could be no quantitative science, and the idea of continuous quantity would have to be abandoned.† In our reasonings from analogy we are apt to overlook this necessary dependence of variations. Thus the Newtonian argument against the wave theory of Light seemed conclusive when, from the analogy of Sound, he argued that waves of Light in passing through an aperture ought to be diffused, and therefore there should be no shadows. But in the first place, the analogy is one involving quantitative differences, for any aperture that we can make has an immense ratio to the length of a wave of light, but may not bear any great ratio to the length of a wave

* CLAUDE BERNARD: *Revue Scientifique*, 1871, p. 188.

† Mr FOWLER felicitously points out that the observation of variations is an integration of an infinite number of applications of the so-called method of Difference.—FOWLER: *Inductive Logic*, p. 175.

of sound,* so that many waves of light can pass through the aperture in straight lines.†

97. The knowledge of causes tends more and more towards a quantitative expression, and is in each case final, when, to the discovery of a function, there has been added the display of the *form* of that function—i.e., the way in which the co-operant factors are combined. I have suggested the term *neural units* for the integrant parts of which Feeling on the physical side is composed, the variations of which units determine all varieties of Feeling, so that every sensation, every perception, every conception, and every emotion has its invariant group of neural units. And we may adopt the term *dynamical units* for the corresponding objective elements of phenomena, each of which differs from every other in its invariants—each is what it is in virtue of an *invariant quantity*. A tone, for example,

* Waves of light are from $\frac{1}{43,000}$ to $\frac{1}{70,000}$ of an *inch*, whereas a wave of sound may be several *feet*.

† "If light consisted in Pression or Motion propagated either in an instant or in time, it would bend into the shadow; for pression or motion cannot be propagated in a fluid in right lines beyond an obstacle which stops part of the motion, but will bend and spread every way into the quiescent medium which lies beyond the obstacle. The waves on the surface of stagnating water, passing by the sides of a broad obstacle which stops part of them, bend afterwards, and dilate themselves gradually into the quiet water behind the obstacle. The waves, pulses, or vibrations of the air wherein sounds consist bend manifestly, though not so much, as the waves of water; for a bell or a cannon may be heard beyond a hill which intercepts the sight of the sounding body, and sounds are propagated as readily through crooked pipes as through straight ones. But light is never known to follow crooked passages nor to bend into the shadow."—NEWTON: *Optics*, Query 28. It is interesting, now we know the fact that light does bend into the shadow, to notice how Newton, having no idea of Interference, missed the rational inference that the difference of degree recognised between the waves of water and the waves of sound might also be assumed between the waves of sound and those of light.

is the product of two factors—undulations on the one hand, neural changes on the other; each factor having its invariant quantity. The existence of the phenomenon "tone" is determined by these, and it varies with their variations. For each tone and each *nuance* of tone, there is a precise number of associated rhythmic pulses and neural units. These pulses and these neural units are susceptible of increase or decrease; the pulses may be irregular, not rhythmic, or they may be too rapid in their recurrence, in which cases no tone is produced; or the neural changes may not be responsive to the pulses, the excitation may be too faint or irregular, in which cases also no "tone" is produced. The factors which are co-operant in "tone" have not co-operated in these cases.

98. Men long ago detected the factors of Sound, but this knowledge, though useful, was limited in reach because deficient in quantitative precision. It was a discovery of the function, but the *form of the function* was still required. When they discovered that each different tone has its invariant undulations, and when they ascertained the quantities of these dynamical units, so that a given number of pulses in a second would always (with a normal ear) produce a specific note, double that number would always produce the octave of that note, treble that number would always produce the fifth of the octave, *i.e.*, the twelfth, and so on—this discovery of the invariant units (the values of the factors) enabled them to treat most questions of Sound as questions of Calculation. With this precision came certainty. Up to that time it was conceivable that the objective factor of Sound was not the undulation of the sounding body, but something which

the undulation accompanied. This was no longer thinkable when the undulations were displayed as the determinants, by the exhibition of their invariant dynamical quantities. Even should some unsuspected discovery prove these undulations to be cases of a more general condition, these values would still remain as the invariants of musical Sound.

99. To those who fail to appreciate the significance of identical equation as the *test* of a true inference, because identical propositions in themselves seem trifling, it may appear that this Law of Invariants is also trifling. This will hardly be the case if we reflect on the many examples showing that numerical deductions often lead to the discovery, no less than to the proof, of laws in cases where the complexity of the phenomena masks the real determinants. A numerical equation often suffices to point out an unsuspected community between phenomena apparently unallied. If the effects follow the same mathematical laws, their causes must be quantitatively identical, and this will involve a qualitative identity in the causes amid the diversities of the attendant circumstances. The invariability of all relations has its most perfect, if not its only perfect, expression in this Law. As Comte remarks, this invariability is tacitly supposed in every arithmetical operation "qui nous offre, comme en tout autre cas scientifique, l'accord d'une prévision intérieure avec un résultat extérieur. Un tel accord serait toujours fortuit et souvent impossible si l'esprit et le monde n'étaient pas assujétis à des lois fixes, permettant leur harmonie habituelle. Il suffirait même d'attribuer la vie au milieu inerte, dès lors susceptible de variations indéfinies, pour

que nos prévisions numériques se trouvassent dépourvues de réalité constante."* Hence the great instrument of Science is to be sought in Mathematics, and all its developments are developments of the fundamental conception that the modifications of the External Order are quantitatively determined — are questions of degree.

100. By the term dynamical units, which I use in preference to material units, there is avoided the possible misconception of supposing that the invariants of any phenomenon are limited to *quantity* without regard to *position* or *quality*. The force exerted by any body is partly indeed due to its magnitude, but also to its relative position; a larger body in the same relative position will produce a larger effect, but the effect is not the product of the quantity irrespective of the position. Newton observed that it is not the whole attraction of the sun which disturbs the motion of the moon round the earth, but only the *difference* between the force thus exerted, and the force exerted by it on the earth; for it is this difference which affects the relative position of the two bodies. No two bodies act on each other (in producing change of direction or velocity) by their absolute position, but only by their relative difference in position. Every change is the resultant position of the dynamical units involved. The sum of Existence being taken as constant, every change, every modification, must be either a *plus* or a *minus*. Every *plus* in one direction necessarily involves an equivalent *minus* in the opposite direction: what is positive here must be negative there; there can be no addition without sub-

* COMTE: *Politique Positive*, I. 464.

traction.* The Law of Invariants declares that all the varied phenomena of the universe are quantitatively determined; and the three signs of *plus*, *minus*, and *equality* represent the three *summa genera* of relations.

101. I cannot afford space here for applications of this Law to scientific questions; nor indeed is it needful to anticipate what every reflecting reader can do for himself. In proposing the Law as the supreme cosmical axiom, the correlative of the logical Principle of Equivalence, I am not ascribing to it any value as a *guide* in research, but only as a *test*. The difficulty in each special case is to discover what *are* the invariants; precisely as in every application of an axiom, it is not the certainty of the axiom, but the certainty of the relations brought under it. The progress of Science is the successive ascertainment of invariants, the exact quantitative determination of groups. Every clearly-defined phenomenon, every law of phenomena, is the establishment of an invariant group. All mathematical truths are of this kind, from the measurements of angles to the tabulation of functions. All physical and chemical truths are quantitative expressions of invariants, whether seen in the parallelogram of forces or in atomic combinations. All biological truths are of this order, though their quantitative expression is often excessively difficult, owing to the great complexity of the determinants. It is the same with sociological truths. The experience of every day assures us that we are liable to incessant error when relying on our unaided inferences, and drawing conclusions simply on the ground of a resemblance between

* Compare the interesting Essay by KANT (*Werke* i. 20) *Versuch den Begriff der negativen Grössen in die Weltweisheit einzuführen*; especially § 3.

phenomena as these are sensibly appreciated; for the illusions of *sensible* Inference are many, and what appears to us to be a complete identity is afterwards discovered to be only a partial, superficial identity amid profound diversity. The same experience assures us that, however superficially distinguished, two phenomena are often profoundly connected, and are regulated by the same laws; and that whenever we have ascertained their invariants, whenever we have their quantitative expressions, our *rational* Inference, which overrides the sensible varieties, is absolutely certain. With these invariants in our power we can predict with certainty the effects of any change. We have the keys which unlock the mysteries. We know what is and will be.

RETROSPECT.

102. A solution of the great problem of Certitude is only possible through data furnished by an investigation into the origin, scope, and purpose of knowledge. These three points ascertained, we shall have ascertained what Certitude is, and what it effects. The origin and scope of knowledge we have seen to be in Feeling; its purpose, right guidance in Action. The thought that does not accurately reproduce the order of sensibles cannot rightly guide our actions. Certitude is not simply strength of conviction; that is its subjective aspect, and is itself only a state of feeling. For certain knowledge, something else is needed; and that something is the correspondence between the subjective and objective in all that is inferred from the feeling. The proof of such correspondence is nothing but the proof that our inferences from the feelings

are equivalent to the feelings they ideally reproduce; and this proof can only be given in action, which translates the inference into feeling, the prevision into fact. We see certain objects, and foresee what will be the consequences of their action on each other or on ourselves; and if we only foresee what we or others have previously seen under these circumstances, our prevision will be exact, because it will be the equivalent of vision; if we foresee more than what has been seen, or something different from what has been seen, our prevision is doubtful, and must be tested before certainty can be reached.

No doubt is possible to Feeling, only to Inference. When the data of Feeling are carried up into the Logic of Signs, and the arithmetic of Perception is transformed into the algebra of Conception, theories replace the observations they condense, and Certitude has its source and limit in the equivalence of signs and their significates. When our symbols can be retranslated into feelings, our conceptions into their corresponding perceptions, and when the Ideal Order thus, under the forms and conditions of Abstraction, represents the Real Order, we call this Truth, not simply Conviction. The Certitude in ideal constructions is thus only another aspect of the Certitude of Feeling.

It is important to bear in mind, that although our definition of Truth as the equivalence of signs and their significates embraces both what is called formal or ideal Truth and real Truth—since the sign may be an idea or a sensation, and in the first case its significate is another idea, in the second another sensation—we can only regard that Truth as valid in reference

to the purposes of knowledge which admits of an accurate interpretation of the signs into feelings. Thus it may be rigorously true that Abracadabra is a first intention—if such is the meaning affixed to the signs—but the truth has no validity, unless the signs have sensible values, and Abracadabra be an object capable of affecting our senses. On the contrary, the abstract formula for the increased velocity of a moving point: $v = \frac{ds}{dt}$ is not only true, but valid for knowledge, because its signs are sensibly interpretable.

103. It is instructive to compare the ancient Magi with modern Physicists. Both claim a power over Nature; by virtue of their penetration into her arcana they are both wonder-workers. But the promises of the one are vain, the promises of the other are fulfilled. Both express their theories of the universe in cabalistic signs, unintelligible except to adepts; both have a repugnance to the employment of terms drawn from the language of living men, and a preference for terms drawn from some antique language. But although the algebraic formulæ which stud the pages of a modern treatise on Light or Electricity are not less mysterious to the unmathematical mind than the symbols of the astrologer and alchemist, they do in truth condense the results of centuries of patient observation and verified inference, and can readily be translated into fact: every equation represents a physical truth. Both Magi and Physicists construct their formulæ by the aid of observation and inference; in the theories of both, fiction largely mingles with fact. But the fictions and inferences of the one are, what those of the other are not, unveri-

fied suggestions, and are offered in lieu of observations instead of aids to further observation. The power of Science lies in this, that its inferences and fictions are always either reproductions of Experience, and submitted to its control, or else are treated simply as provisional explanations awaiting verification.

Need we add, that, for the most part, metaphysicians have constructed their theories of the universe on that illusory Method which was so impotent in the hands of the Magi? and that, if Metaphysics is ever to reach a solution of its problems, it must relinquish that Method altogether for the Method of Science, which has proved its power?

PROBLEM III.

FROM THE KNOWN TO THE UNKNOWN.

Τὸ πόρσω δ' ἔστι σοφοῖς ἅβατον
κἀσόφοις· οὗ μιν διώξω κεῖσ' ὅς εἴη.

PINDAR: *Olymp.* iii. 74.

"Faut-il que le métaphysicien possède toutes les sciences? Non, sans doute; il suffit qu'il constate ce qu'elles ont de commun: toutes les sciences se composent d'idées, de jugements, de pensées, d'opinions, de croyances, effets de jugements portés et d'affirmations prononcées; ainsi il aura rempli sa tâche s'il découvre les principes sur lesquels elles sont fondées; s'il signale et détermine le caractère propre de l'idée et du jugement, le caractère de la vérité, et ce qui distingue la certitude de la simple probabilité. . . . . s'il trouve quelques principes généraux et fondamentaux de méthode applicables à toutes les circonstances."

DE CARDAILLAC: *Études de Philosophie*, i. 162.

"Allgemeine Begriffe sollen zwar der Stoff sein, *in* welchen die Philosophie ihre Erkenntniss absetzt und niederlegt; jedoch nicht die Quelle *aus* der sie solche schöpft: der *terminus ad quem*, nicht *a quo*. Sie ist nicht wie Kant sie definirt, eine Wissenchaft *aus* Begriffen, sondern *in* Begriffen."

SCHOPENHAUER: *Die Welt als Wille und Vorstellung*, ii. 44.

FROM THE KNOWN TO THE UNKNOWN.

CHAPTER I.

NATURE AS REFLECTED IN SENSE AND THOUGHT.

1. THE sphere of knowledge is for ever widening. From hour to hour and from day to day the individual experience is enlarged; from century to century the experience of the race. In direct contact with Nature through Sense, and in indirect contact through Thought, man is incessantly bringing more and more of the illimitable Unknown within the circle of the Known—*assimilating* it, incorporating the new experiences in the old, and thereby more and more adjusting his actions to the course of things.* The analogy between the growth of an organism and the growth of knowledge is further recognisable in the inevitable mixture of materials unfit for assimila-

* The reader may be reminded that whenever I use the words Sense and Sensation, it is merely to indicate the predominance of the sensory element. There is always brain-work conjoined with sense-work, Judgment co-operating with Sensibility; and *sensus* is only separated by abstraction from *consensus*. Nature reflected in Sense, therefore, is equivalent to the world of Perception. Derivative from this, and in many respects contrasted with it, is the world of Conception, or Nature as reflected in Thought.

tion. This unfit material, if not rejected, but allowed to fix itself in the structure, causes disturbance of function in the organism (Disease), or disturbance of function in the mind (Error). The rejection cannot always be effected. Both in animals and in man we note a large and constant admixture of Error and Fiction entering into their picture of the External Order. In so far as Nature is felt, we may say that Nature *is* what is felt. All the direct presentations of Feeling are true; but in so far as these are represented in images, and still more when they are symbolised in words, there is always an element of uncertainty, and a departure from reality which frequently leads to mistakes in action. The mistakes of Perception are indeed notorious, but they have the advantage of being easily rectified. Still more frequent, and less easily checked, are the mistakes committed when the Logic of Feeling is replaced by the Logic of Signs, and general symbols are substituted for particular experiences. Hence the immensity of the field of human error; greater than that of the animal, as the range of man's knowledge is incomparably wider. For the experience of men is not simply, like that of animals, the registration of the order of events in Feeling; it is also the registration of feelings generalised and reconstructed in symbols. Man sees Nature not only reflected in Sense, but reflected in Thought, which transfigures the data of Feeling by ideal constructions, and thus forms Religion, Art, Philosophy, Science, the symbolical representations of a world far removed from the world of Sense. He lives a double life and has a double world—the world of Feeling and the world of Thought, that of sensations and images and that of

abstract ideas. The Present is to him a complex web, with threads of the Past and threads of the Future inextricably interwoven. Unlike the animal, whose mind is occupied with particulars and realities only, he is moved almost as much by imagined possibilities as by realities; and possibilities and abstractions are to him determining *motives* of such force that they are constantly mistaken for realities.

2. The popular belief is, that because the external order of qualities has its correlative internal order of feelings, therefore the Universe or Macrocosm is truly reflected in the Mind as a Microcosm. Having already argued that the Cosmos arises in Consciousness, and is, on one side at least, our creation, I shall not be supposed to deny that, in a certain sense, the popular belief is acceptable. But the terms demand precision. We must be clear as to whether we refer to the world of Sense or the world of Thought; and again, whether we refer to the objective or the subjective aspect of each. The organism may, in like manner, be said to reflect its medium, to be a microcosm of its macrocosm. Although constructed out of materials drawn from the medium, and existing only in relation to the medium, the organism, when constructed, has a life and movement of its own. It is therefore self-determined, in so far as its movements are the resultant of the activities of its organs and tissues. So the mind. The microcosm in Feeling, once constituted, does indeed reflect the macrocosm, in so far as all the inward processes have correlative external processes (somewhere in space and time); but the combinations and recombinations of these processes do not always follow a course parallel to the combinations in things—each is determined by

its own activities. The great processes of Nature move inexorably on their path, whether they are felt and thought or not. The stars pursue their courses, acids rush into union with bases, seeds germinate, and nebulæ condense, in virtue of their inherent activities; and our feelings and thoughts also succeed each other, combine and recombine, in virtue of *their* activities, as well as in virtue of the external actions. The great harmony of the universe issues from the mutual adjustment of its forces; the harmony of our microcosm issues from the adjustment of its movements to the movements of the External. It is by identification of ourselves—body and mind—with Nature, that we truly live: all non-identification is error, disease, death.

3. The reader sees that I am here speaking of Nature *not* as presented and represented in Sense and Thought, but as the pure Existence, the ultimate Reality, believed by all except idealists to *exist* independently, though only felt and known under subjective conditions: the postulated macrocosm which in us is a microcosm; the Universe as distinguished from our Cosmos; or, to word it differently, the Sum of Things, as logically distinguished from that portion which is comprised in our feelings. What I wish to bring forward is the marked difference between our direct and indirect relations to this External Order. In Feeling, the presentation is direct, and Nature is only what is felt. In Thought, the presentation is symbolical, and although these symbols represent feelings, they are removed from Reality in a double manner: first, they are general, abstract, never therefore accurately reproducing the

images or feelings they stand for; secondly, as symbols they have properties and laws of their own, not always the properties and laws of sensation. Although Thought necessarily follows the fundamental laws of Feeling—since it is derivative from Feeling—it has also laws peculiar to itself. This will hereafter be shown in detail; for the present, let it suffice to illustrate the position by the analogy of Algebra and Arithmetic. In Arithmetic, we deal with definite numbers, precise values, always the same; in Algebra, these numbers or values are *general*, the symbols *a*, *b*, *x*, *y*, *z*, &c., standing for *any* values we please to assign, and therefore embracing great varieties. The perception of a horse, or the image of a horse, is always of an individual; but the conception expressed by the symbol "Horse," stands for *any* horse, all horses; so that much that is true of the conception is not true of the perception, and *vice versa*. The conception generalises the particulars by *eliminating what is individual in each, and abstracting what is common in all.* In consequence of symbols having laws and properties of their own, there are many operations possible to Algebra, and eminently serviceable, which are impossible to Arithmetic; hence imaginary quantities, quantities less than nothing, and square roots of these—all which are arithmetically absurd. In like manner, although the laws of Feeling operate in Thought as the laws of Arithmetic in Algebra, yet there are operations possible to Thought, and eminently serviceable, which are impossible to Feeling.

4. Thus it is that Nature when reflected in Thought is an ideal construction, having only symbolical rela-

tion to reality; and it requires retranslation from the symbols into the feelings symbolised before it can be accepted as real. Kant says that our thoughts are necessarily untrue, because it is we who think them. He would have said the same of our feelings. But ought he not rather to have said that our thoughts, being symbolical representations, must, *as such*, be unlike the reals they represent, yet may be true in their symbolical sphere, and must be true as far as they are the rational equivalents of feelings? Hegel reverses the Kantian dictum. To him the symbols are the only truths, because they are generals. He holds that Thought, in point of fact, though not in point of time, precedes and evolves Feeling, and that the Categories which may be found in all perceptions are placed in them by Thought. When we perceive a piece of sugar—according to Hegel—we find it to be hard, white, sweet, &c., and then, announcing what we have found, say that all these abstract properties are united in one subject. So also when we apprehend two events standing in the relation of cause and effect, Sense informs us only of the separate occurrences; but that one of these is cause and the other effect is not perceived by Sense—the causal nexus is apprehended by Thought.

5. This reasoning is ambiguous. If it simply expresses that we feel the properties hard, white, sweet, &c., but not the *object* apart from these, or that we perceive the two events and their succession, but not a causal nexus as a third sensible, the reasoning is correct, but trivial. "Object" and "nexus" are assuredly abstractions, not feelings. But if Hegel means more than this—namely, that thoughts have a

source which is not that of Feeling, and that abstractions are prior to their concretes—then, I submit, it is due to his mistaken psychology, which distinguishes Human Feeling from Animal Feeling, on the ground that Thought is immanent in the former, and not in the latter. The reader is aware that I also hold Thought to be immanent in Feeling (in the general meaning of Thought, as the active side of the neural process—the grouping, in contradistinction to the materials grouped); but in this general sense, in which it stands for the "activity of the mind," I deny that it is peculiar to man. The special meaning of Thought, and that which Hegel here has in view, the Logic of Signs, is, I believe, only to be referred to man. The animal thinks, but only in sensations and images, not in abstractions and symbols. The animal perceives no "object," no "causal nexus," not being able to form such abstractions from his feelings. If man is gifted with another power, and thinks an "object" or a "causal nexus," it is because he can detach and fix in signs, rendering *explicit* what is *implicit* in Feeling. Had he not felt in the concrete what is expressed in the abstract, no power of Thought would have revealed to him this object and this nexus. Let us examine the genesis. A piece of sugar is perceived by both animal and man, that is to say, a *white* feeling (*sit venia verbo*) is first present, then a *hard* feeling succeeds it; the two feelings coalesce, and the group *white-hard* comprises the total of experience up to this point. This group is enlarged by the addition of a *sweet* feeling, and the coalescence of white-hard-sweet experiences is the unity of an unbroken succession. The sweet is hard to the hand and white to the eye. The sight

recalls the taste, the taste recalls the touch. The unity is thought by the animal when the experiences are grouped, and this same unity is thought by the man in the same way. But the man takes a further step, detaches the unity from the experiences unified, abstracts the group, and fixes it in a symbol, calls the group "sugar," and calls the feelings grouped "white," "hard," and "sweet." The group is what they are; but because it is separately named, and the name is used apart from any one of its significates, the tendency to substantialise abstractions converts it into a thing by itself—the object; and all its constituent qualities become abstract properties; this the more readily, because similar qualities are met with in other groups. This abstract object, we are then superfluously assured, is not a sensible. It is not a sensible, because it is a symbol of sensibles. The same genesis of the causal nexus need not be detailed here.

6. The necessary co-operation of brain-work with sense-work, of Thought with Feeling (which we shall hereafter see to be inherent in the Psychological Spectrum), carries with it the conviction that, in the animal as in man, Thought is immanent in Feeling, although the materials operated on in the Logic of Signs are different from those operated on in the Logic of Feeling. It further carries the conviction that whenever feelings have been carried up into symbols—as in man, and especially in the heritors of a long past—the co-operation of this symbolical product becomes more and more dominant, so that analysis discloses the intervention of abstractions even in our familiar experiences. A child sees a triangle otherwise than as it is seen by a dog; and the geo-

meter sees it otherwise than the child; each sees it as he has learned to see it—the dog by direct experience, the child and geometer by direct experience enlightened by the experience of the race. Child and dog have definite sensations; but the dog does not interpret these by abstractions: he knows nothing of lines nor of angles; he has a certain feeling, perhaps, of the outlines of the form which is distinguishable from other forms. The child, having already learned from others what lines are, and perhaps what angles are, draws this figure with his eye, just as he will draw it with his hand; but he must be taught that the figure is a "triangle," and what are its properties; unless he teach himself by contemplating the relations of these lines in comparison with other lines. Having reached this stage, detached this form from other forms, fixed it in a name, and under that name grouped all that he or others have contemplated, he has the geometer's conception of a triangle, which ever afterwards will insensibly mingle with his perception of triangles.

7. We can now understand in what sense the microcosm may be said to represent the macrocosm. The two cardinal facts,—that the internal order is *primarily determined* by the external order, and that secondarily the internal order has also a *principle of movement in itself*,—prove that while much of our internal order must be accurate, because a real reflection of the external, much of it must be inaccurate, because an ideal reflection. Whatever we *feel*, must be true; whatever we *infer*, may be false; whatever we *think*, may be true as a symbolical operation, but may be false when the *general* symbols are interpreted by *particular* values. The

order in feelings is a registration of past experiences, by which we adjust our actions to recurrent facts of similar appearance. The order in thoughts is a registration of *generalised* experiences, by which we adjust our actions. As our knowledge becomes more extensive, it becomes more special as well as more general, therefore our adjustments become more accurate. The passage from the Known to the Unknown is one of constant trial. We see, and from it infer what is not seen; we intuite, and conclude. Our inference and our conclusion require verification. We test them by reducing the inferences to sensations in the case of Action, or by reducing the inferences to intuitions in the case of Reflection. Thus it is that the ground of Certitude is either a sensible, or its rational equivalent. It was formerly pointed out that Inference is always present, even in Perception and Intuition; thus our simplest judgments, being inferences, contain a latent possibility of error, so long as they remain unverified, although they are habitually taken for granted, and acted on as if already verified. The facility of verification in the case of Perception prevents our remaining long in error, when any interest is attached to the truth; we can so easily try whether the object seen *has* the qualities inferred. It is otherwise with Conception. There, in spite of our interest in ascertaining the truth, an error will sustain itself against evidence for centuries. We go on repeating without suspicion the judgments, the assumptions, the superstitions of our ancestors, because we are unable to see the perceptions and relations compendiously expressed in these judgments, assumptions, and superstitions. The capricious play of one

man's fancy has assigned a curative virtue, or a malevolent influence, to some object; and although the supposed cause may lie as remote from all bearing on the event as a flight of crows is from the result of a battle, or the passing of a piebald horse is from the success of a financial enterprise, yet the mere enunciation of a causal connection suffices to impress the uncritical hearer with a belief in its truth; and this belief, transmitted from family to family, from generation to generation, comes to be the heritage of men who pique themselves on their rationality. Round this nucleus of fancy cluster the notions and the interests, till the fiction becomes a very serious part of life. Holy awe and abject terror guard fictions from investigation; and theories which, when investigated and reduced to the evidence of the senses, are seen to be so flagrantly absurd that they are cited among the monstrosities of reason, are among the most powerful motives to human conduct. Churches and temples, mosques and pagodas, consolidate and consecrate these aberrations of the intellect. Hence the fierce opposition of all priesthoods—the philosophical no less than the religious—to the dissolving agency of Doubt, the disturbing anarchy of Investigation. We have but to read the accounts of the early beliefs of mankind, or the present beliefs of savages and semi-cultivated nations, to see how large a field pure fiction occupies; we have but to open any work of science half a century old to see what a mixture of wild guesses and ill-observed facts could gain acceptance from the most serious; and finally, we have but to consider the very process of Science itself to see that it is ideal construction consciously and uncon-

sciously employing fiction as the stop-gap of defective experience.

8. There is no countenance given either to scepticism or to apathy by this recognition of the symbolical nature of our world of Thought; it only calls attention to the nature of Certitude, and to the criticism which should accompany research. The world represented in Philosophy may be likened to the life which is represented in the Drama. In a play we have no accurate reproduction of what does occur, or ever did occur, but a reflection of the elementary motives, incidents, passions, *under artistic conditions.* This last clause is emphasised, because it is the essential point, and is too often slurred over. It says that when the passions and events are reproduced by the dramatist, they are transformed into artistic passions and events; and the conditions of Art necessitate the omission of much that is real, because it is too unwieldy for expression, while much also is transposed and altered, because the reality would be unsuitable for the desired end. Thus all is selected and re-arranged according to the internal conditions of theatric representation, and not according to the internal conditions of the life represented. Life is idealised. Nothing is really presented. A few yards of painted canvas stand for the illimitable sky and the far stretching sea; the glittering goblets are not of gold; the wine quaffed from them is toast-and-water, or mere air; no blood flows from the fatal wounds; no tears wet the eyes of grief. And yet, although all is thus unreal, the real world is represented; the facts of life are there, both the facts of common experience and the facts of imaginative experience. The idealism

is founded on realism. He is a poor and prosaic spectator who refuses to accept the forms of Art because what they give is not "like life." We meet with such spectators, and hear them assert, with an air of superiority, that off the stage men and women do not speak their thoughts in lengthy monologues and audible "asides;" do not feel such emotions, nor express them in rhythmical and stilted language; do not stride and attitudinise, nor comport themselves in the least like the actors;—all which is very true, and quite irrelevant. Contrasted with this prosaic spectator is the simple uncritical spectator, who accepts the representation as a reality, and believes—for the moment—that the masks are not mere *personæ*, but persons, men and women living through these events. And there is a third spectator, the critical, who knows that he has before him a representative world, which is to be estimated from two sides,—first in its representation of the real, the truth of the characters and events; and secondly in its artistic truth, which has reference not only to the effect, but also to the means by which the effect is reached. Without for a moment believing that men and women off the stage speak and act in this way, he sees that this is the way of artistically representing their emotions and actions, under the conditions of the theatre. When the critic objects to a dramatist or an actor that such or such a detail is not true to Nature, he means that a falsification has been substituted for an idealisation; the detail is not consistent with the ideal representation; as, for example, when the grief of the heroine is so expressed that it suggests the grief of a washerwoman, not of a princess.

9. These three modes of estimating the Drama may be paralleled in the modes of estimating the philosophic representation of Nature. One thinker denies that the microcosm reflects the macrocosm at all, and says our knowledge is phantasmal, unreal, because it is ours. Another believes that the macrocosm is just what we feel and think it—would be standing there in all its visible and tangible qualities, even if unseen and untouched. A third believes that it is partly reflected and partly symbolised in the microcosm—that Nature is what is presented in Feeling; and that in so far as the symbolical representation of Thought corresponds with the presentation of Feeling, Nature is to that extent—no further—reflected in Thought. Nor is it any serious objection to this view, that symbols by their very constitution are unreal, and having properties peculiar to themselves, will often, when uncritically employed, arrange themselves in an order which is at variance with the external order. It is against this tendency that criticism has to be on the alert. The dramatist and actor will falsify when attempting to idealise; the thinker and student will misinterpret when attempting to rationalise. And the play may delight the audience by its æsthetic charm in spite of its departure from truth; the system, or theory, may captivate the reader by its logical coherence, in spite of its not being interpretable in terms of experience. Emotion counts for almost as much in Philosophy as in Art, though this is not recognised.*

10. While thus marking the sources and nature of

* This is true in a much wider sense, for, as we shall hereafter see, Cognition has its source in Emotion.

error, let us not forget that the final purpose of Knowledge being guidance in Action—and not the mere delight of intellectual gymnastics manipulating symbols—the value of a proposition is always tested by its interpretation in terms of Feeling; and this testing is the work of Criticism. Our world of Thought is a strange mixture of truth and fiction—of Experience condensed in symbols, and of inferences deduced from symbols, and taken for reals; but the advance of Humanity tends more and more to enlarge the fund of truths, and to disclose the pitfalls on its path. The history of the race is but that of the individual "writ large." Our direct contact with Nature is through Feeling. The feelings distinguishable among each other group themselves into classes, are condensed in perceptions, which again are generalised in conceptions, which are condensed in theories and systems. Science is the great storehouse of generations; and the task of each generation is lightened because in this storehouse materials, which centuries of labour have garnered, lie ready to every man's hand. We are the heirs of Time. Unhappily, it is in the nature of heirs to be heedless of the origin of their wealth, ungrateful to those who created it. We accept what comes to us, heedless of the signs it bears of hard-handed toil, struggle, and suffering. Who on descending to breakfast, and finding the well-prepared table, gives a thought to the invention, the energy, and the misery which during millions of years have been working towards that result? The eye passes without pausing over each familiar detail, as if each were not a condensed fragment of the history of our race. On the bleached damask stand the silver teapot and electro-plated

toast-rack, the china service and glass butter-cooler, the bronzed urn and the morning's *Times;* but they call up no image of the plantations of China, the factories of Sheffield, the potteries of Staffordshire, or the epitomised nation of Printing-House Square. The very bread and milk, accepted as if they were the free gifts of Nature, carry the meditative mind back to an unassignable period, when some full-eared grass, itself the product of a slow development, aided by man's care became the parent of the wheat we sow, and tempted man to cease restless wandering amid undrained swamps and uncleared forests in search of game, thus beginning Civilisation, which was to replace the nomadic existence. With the agricultural life came the domestication of animals and their improvement; and the milk on our breakfast-table is an interesting example of a natural function which has been raised into a social function; the small quantity of milk given to the cow for the nourishment of its calf is exaggerated into the forty pints daily for the nourishment of several families.*

If these representants of man's struggle with material existence speak of a long past and an eventful history, the *Times*, as a representant of his spiritual struggles, tells a not less wondrous tale. The types from which this paper was printed are of modern origin; but how many centuries upon centuries have revolved while the Language was developed which comes to us like the air we breathe?

11. Everywhere we are confronted by the work of

* In the wild state a cow yields milk only during the brief period of calving. The milch-cow yields milk uninterruptedly for years. The Damarras have domesticated the cow, but they only get about three pints of milk daily.

our ancestors—in the material world, which they wrought out of the morass and jungle; in the spiritual world, which they wrought out of the chaos of sensation. We cannot take a step but in the footsteps of the millions who went before us; we cannot think a thought but the minds of millions have made it possible for us. The axe of the colonist clears the way. The intellect of the explorer distinguishes and classifies. What we know as Nature is this twofold product of ancestral toil of hand and eye, guided by the mind which hand and eye have educated. When we now look upon the pleasant landscape of nodding corn, trimmed hedgerows, farmyards, parks, canals, bridges, and railways, and picture to ourselves the uncleared forests peopled by savages and wild beasts, we become aware that "Nature" represents man's transfigured *Desire*. His lower wants and higher wants, his nutritive and emotive needs, have been the agents of this transformation, subduing the stubborn forces to his pleasure. The Nature reflected in his world of Thought is also the representative of his Desire; and what are now cognitions were primarily emotions; the very objects of speculative contemplation being selected and created under the *directive* influences of some deep-seated want. The curiosity to know what is the real order in things, and what was the process of their evolution,—this passion of Philosophy which now bears so little traces of its utilitarian origin,—is but a higher stage of our primitive wants. We see only what interests us; and the primitive interests are physical. The animal tries each new object in reference to its edibility, or other possibility of sensual gratification. The infant draws everything to its mouth. The horizon of interest

slowly widens. The fields are measured long before Geometry arises; the stars are watched as landmarks in the sky long before Astronomy arises; and when these sciences emerge, they develop independent interests, and are at once the stimulus and the gratification of wider wants. They change the face of things. We can never again behold the heavens which appeared to the early navigators and to the Chaldean shepherds; that panorama has been replaced by one which is the consolidated thought of Hipparchus and Kepler, of Galileo and Newton (though we may never have heard of these men's labours). For it is the mind which sees, and the mind sees what it has been taught to see. We are never left to ourselves. From the first the child is told "what" things "are;" his attention is directed to the distinctions already established. At his mother's knee he learns the legends of a mythological past; at his school-desk he spells the wisdom of a line of sages; in his library he fortifies himself with the results of research. The staple of his mental tissue is, for the most part, woven from threads separately wrought by others. His utmost effort is to see from the shoulders of the Present a little further into the Future. Every one is weak standing alone; he leans on others, and is strong. By himself he can do little; by their aid he yokes the streams and the winds, harnesses steam, and drives electricity. A radiation of the powers of all exalts the powers of each. A man of genius is one whose sympathies are unusually wide; to him the work of other men converges, and what they felt he feels; but he is dimly conscious that what thus comes to him is not his own creation; and

hence the thrill of awed surprise with which he greets the dawning of a new idea upon his soul—

> "Like some watcher of the skies,
> When a new planet swims into his ken."

12. Thus on all sides it appears that Nature embodies the transfigured desires of man, and the idealising spirit of man. It is the work, the emotion, and the thought of Humanity. Watt and Arkwright have not more transfigured and intensified the available forces of Nature, than Wordsworth and Turner have transfigured and idealised her æsthetic aspects. It is in this sense we must interpret Comte's sayings, that the living are more and more dominated by the dead; and that between man and nature we must place Humanity.

Summing up the contents of this chapter, we say there are two ways in which Nature is reflected. There is the world of sense, which is the purely animal region. Here the Logic of Feeling is supreme; yet even here the world is permeated and moulded by Thought, if we understand by Thought simply the active side, the Grouping; and there is the same operation of Judgment in the construction of perceptions as in the construction of conceptions; but the Logic is that operating on Feelings, not on Signs. Rising out of this, and above it, is the purely human world, the world of ideas, in which sensations are replaced by symbols; and these, when separated and recombined by their own Logic, become Objects, Relations, Laws, which are then *reflected back* upon Nature, so as to appear there in the guise of unconscious existences, independent of all sentiences. The animal world is a continuum of smells, sights, touches,

tastes, pains, and pleasures; it has no objects, no laws, no distinguishable abstractions such as Self and Not-self. This world we can never understand, except in such dim guesses as we can form respecting the experiences of those born blind, guesses that are always vitiated by the fact that we cannot help seeing what we try to imagine them as only touching. But we know that our world is widely different from the animal world, because it is suffused with symbolical thought. Our perceptions are never fairly isolated: the past and future are reflected in the present, the abstract mingles its symbol with the concrete feeling. If we see the bud, after we have learned that it is a bud, there is always a forward glance at the flower, and a backward glance at the seed, dimly associated with the perception. But what animal sees such things? What animal sees a bud at all, except as a visual sign of some other sensation?

It is not, however, the purpose of this Problem to dwell on this twofold aspect of Nature, but rather to specify the logical procedures by which our wealth of Thought has been accumulated, and may be increased, and how the infirmities of the mind are to be guarded against.

CHAPTER II.

JUDGMENT.

13. THE operation named Judgment by logicians has a much more extensive sphere than the text-books assign to it. Regarding the organism psychologically, we see that this operation is one which connects an action with a feeling (more accurately, one feeling with another), and that the ordinary logical process of connecting a predicate with a subject is but a particular mode of this operation. Judgment is simply Inclusion—or, as we say, Grouping. The act of Inference necessary for the simplest perception is an inclusion of *revived* feelings in a group with *actual* feelings; and the nature of this act is the same, whether the materials operated on be sensations, images, or symbols.

Although it is requisite to call attention to this extension of the term Judgment, ordinary usage is so opposed to it, and limits the term so strictly to the sphere of Thought, that I generally employ the phrase Logic of Feeling when referring to judgments of Perception or Emotion, and the Logic of Signs when referring to judgments of Conception—that is, ideas, thoughts. It is enough here to have indicated that although Judgment, in its technical sense, is simply

predication (the connecting of one or more predicates with a subject—the assertion that something is this or that), in its wider psychological sense it is Grouping or Inclusion.

14. The text-books tell us that man thinks in judgments, and expresses his thoughts in propositions. If we ask, What is a proposition? the answer of logicians and grammarians is that a proposition must have three terms 1°, a *subject*—the feeling or thing spoken of; 2°, a *predicate*—something said of the subject; and 3°, a *copula*, or verb, which *says* it by uniting the two into one. Thus in the proposition: "Rust is formed by the oxygen detached from the atmosphere and combined with iron"—*rust* stands for subject, the *combination of oxygen and iron* for the predicate, and *is* brings the two terms together.

This grammatical distinction may be accepted if by *term* we mean simply a word or a clause. The copula is then one of the three terms. But if term mean object, thing standing by itself, or aspect—*terminus*—and is thus a distinct thought—then we must reject this grammatical explanation, for it does not agree with the psychological process of Judgment. That process has two terms, not three. The copula is not a term, but a total; not a part of a judgment, but the whole of it; or, to speak precisely, a symbol of the operation of grouping. In $2 + 2 = 4$, the symbol of operation is not a quantity.

Some logicians, following Aristotle's hint, declare the copula to be a part of the predicate. Thus in the proposition "gold is heavy," there is the subject "gold," and the predicate " is heavy." This, however, is only going half way. We cannot have the idea of " gold,"

without at the same time the idea of it as existing; the gold *is* any predicate we assign to it, and among these predicates weight takes a place. Thus the copula *is* cannot, strictly speaking, belong either to the subject or predicate, because it belongs to both. It is like London Bridge, which is neither in London nor Southwark, but belongs to both. The terms "gold" and "heavy" separately have no logical status—*that* is given them by the copula, which identifies them by connecting the two groups into one group. The terms are like the imaginary poles of a magnet; the magnet *is* the poles.

15. Judgment is predication. When one feeling, or one idea, is sensibly, or ideally, included in the same group as another, and a predicate, or *mode of existing*, is identified with a subject, or *existent*, there is formed a judgment—true or false—which, when expressed in signs, is a proposition. Having mentally identified the phenomenon Rust with the phenomenon Oxygen combined with Iron,* we say the one *is* the other; and this expression of their identity proves the grammatical distinction between subject and predicate to be purely grammatical; and even that does not find a place in many languages: the Chinese, for example, would not use the copula at all, but say "Rust oxygen and iron;" our phrase "the man *is* bad" is expressed in Chinese "man bad."

16. Hence it appears that the identification of the predicate and subject effected in a judgment, by enabling us to transpose them, and with equal propriety to

* I use the popular formula, though it is not quite accurate. Pure and dry oxygen will *not* combine with iron to form rust; some other factors are requisite, *i.e.*, the presence of moisture and a trace of carbonic acid.

say Oxygen *plus* Iron, is the subject existent of which Rust is the predicate (mode of existence), shows the distinction to be conventional, and shows also the copula to be not a term at all, but a sign of operation. Because the copula is a symbol which may signify many other combinations, there arises the illusion of its separate reality. In the same way, because we say the blueness *of* the violet, and the pleasantness *of* the breeze, we fall into the belief that this blueness and this violet, this pleasantness and this breeze, are really separable. This is sustained by the general character of symbols. There are other violets not blue, and other breezes not pleasant; there are other blue things than violets, and other pleasant things than breezes. Hence the conception of a *subject with variable predicates*—one of the most misleading of logical fallacies. From it has arisen the belief in Motion separable from the Moved, because it is conceived apart as motion *of* something;* Mind, in like manner, has been separated from Man, because we say the mind *of* man; and the phenomena of Consciousness have been separated from Consciousness, as the phenomena of the Cosmos from the cosmic Noumenon. We have only to recollect that a subject *is* what its predicates are, to see that variable predicates constitute the variable subject.

17. Let us replace our simple illustrations with one that involves a greater complexity of terms. "The breeze which whispers through these lime-trees is peculiarly agreeable to the feelings of a hot and wearied pedestrian;" in this proposition there are

* An abstract science of motion has been elaborated, though we do not believe in the reality of a geometrical point.

many words (symbols), each of which condenses many previous judgments, each judgment having been an identification of predicate and subject; but although analysis discloses the multitude of groups here condensed in symbols, the proposition itself condenses all these into two groups, and the little word *is* denotes the operation. It is this one *sign* which knits the two phrases into one, giving to each its *significance.* Apart from it, these terms and their component words are isolated, meaningless. If the terms be uttered apart—*e.g.*, "The breeze which whispers through these lime-trees"—the hearer waits for the sentence which is to complete them. The words float suspended, soulless, mere sounds. No sooner are these floating sounds grasped by the copula, than in that grasp they are grouped into significance: they start into life, as a supersaturated saline solution crystallises on being touched by a needle-point. Subject and predicate are terms which, standing alone, or standing beside each other, have no significance: they are handle and blade, not a knife; unite them into one, and you have an instrument.

18. The motive for insisting on this new mode of regarding the copula is to direct attention to the frequent error of looking on an act of combination as something really different from the groups combined—not different merely *in abstraction*, but having different real bases. Thus the mental act named Judgment is supposed to be an act *sui generis*, issuing from some special fount of Activity—the Soul—and wholly independent of the *agents in action.* The several processes are accepted as these agents in action, but are supposed to be like so much inert clay in the hands of

the potter—*shaped as he wills, and not falling into the shapes which their own movements determine.* The Soul is imagined to be a spiritual Agent acting *upon*, not acting *by*, its own processes: a musician playing on a musical instrument, not an æolian harp thrilling to the accordant tremors of the surrounding air.

19. So long as this hypothesis is accepted there can be no scientific Psychology, for it places the Soul in a region inaccessible to all Verification, and allows the ideal constructions of individual fancy free play. But since many of my readers may be indisposed to relinquish this ancient hypothesis, I will illustrate the position here assigned to the copula by a parallel case not open to objection. Oxygen and hydrogen are known as two different gases, each having its special properties—which means that each has different modes of existence in relation to other things. At one moment their relation to each other is one of mutual indifference, which preserves for each its independence. Suddenly a change in their rates of molecular agitation is effected, and a new relation replaces the former relation: instead of two separated gases with independent properties, there is now one liquid having its properties, which are not those of either gas. This emergent liquid is not a third thing superadded to the two gases; it *is* these two under a new form: it is the coalescence and identification of the two. When we say, Water *is* oxygen and hydrogen, or when we say, Rust *is* the union of oxygen and iron, or Gold *is* heavy, the copula may be a third term for the grammarian, but it obviously represents no third term in Logic, that is to say, is no third neural group intercalated between two other groups.

20. Every judgment asserts that something is. The assertion may be inaccurate. The inclusion of one term in another, the grouping of two feelings or ideas together, being a mental act, may, or may not, have objective correspondence. A group is, but it is only what its components are. There is no more logical impropriety in the assertion, "A centaur *is* a fiction of the poets," than in the assertion, "Gold *is* heavy." To speak mathematically, we have in each case reduced the question to the form of an equation, but we must still solve that equation by assigning the values. The *value* of the existence predicated has to be assigned. If we say "Centaurs exist only in the realms of fiction," this is a first limitation, like saying "Marsupials exist wild only in Australia;" then comes the further question as to the reality of the two realms.

21. Not only does a judgment assert existence, it thereby identifies two aspects. Were it simply the bringing of two terms together, two ideas in juxtaposition, the conjunction "And," would have the power of the causative "Therefore." In "This rose is red and fragrant," there are two judgments conjoined, yet distinct. We might have said, "This rose is red, this rose is fragrant;" the word "and" is an abbreviation of the repetition. Compare, however, the proposition, "Arsenic is destructive of the animal tissues, and (therefore) fatal to life;" here the second clause is seen to be included in the first, identified with it. Fragrance is not the consequence of redness, but fatal to life is the consequence of tissue destruction.

22. An objection may here be anticipated. If we understand the copula to be the *grouping*, and the subject and predicate the group under its twofold aspect,

and if, again, every subject is itself a group of predicates, qualities, and thus every term is a judgment, it may be said that this obliterates all distinction between subject and copula. No; it obliterates the illusion of a separation, but preserves the distinction. A subject is a group—it is a judgment accomplished; but it was once a grouping—a process of inference. The gold which is now a subject, because it groups together the qualities of yellowness, hardness, heaviness, malleability, &c., was originally each one of these qualities: it became what it is by successive incorporations of experiences, successive judgments identifying one feeling with another. Now it is a full total, a condensed group, and we use it as a singular term. We do not pause to consider whether the weight belongs to the metal or to the earth; whether the yellowness belongs to the heavy metal, or to the sun, or to both affecting our sensibility: what we have before us is a single group, with its symbol "gold," and this is a logical subject, ready to be united with other groups by an act of union or copula. An organism is a group constituted by organs, each organ itself a group of tissues, each tissue a group of cells and fibres, each of which is a group. The process by which each of these came to be what it is may be called the physiological copula. The process, thus viewed in abstraction, is in reality nothing but the interactions of the concrete elements. When the process is completed, the product is there. The act loses its position as a copula, and passes into that of the group or product, the subject.

23. There is an unfortunate ambiguity which allows us habitually to use the term *judgment* to signify the

judging process, or act of Inference, and also to signify the enunciation of the product, or the fixing in symbols what is now no longer an inference but a verified identification. If, on the sight of a white glistening form, I infer that there is a piece of sugar, which will be sweet to the taste, this is truly an operation of judging. But when I assert that "sugar is sweet," although this proposition is habitually called a judgment, it is obviously very different from my former act, which was an inference, and might have been wrong; it is an identical proposition, and cannot be wrong unless one of its terms is inferential. The difference is that of a guess we make, and a vision we have. To a chemist, the assertion that water is OH_2, is no more an inference than the assertion that water is cold and can be warmed. Now that the equivalence of the terms has been ascertained, the assertions are little better than tautologies; to make them judgments, in the sense of operations, we must introduce some hypothetical elements, and say "This water, *if* of the same kind as all the water we have hitherto known, will be what we assert it to be."

Language is formed long before psychology has interpreted mental processes; we must therefore accept the terms in use: all that can be done is to point out their ambiguities. Hegel protests against the practice of logicians, when they confound the enunciation, which describes a thing by its marks, with the judgment, which defines a thing by some general notion. Enunciations, he says, are tautologies, not judgments.* I shall presently have to call attention to the fact that the majority of logicians, when

* HEGEL: *Logik*, iii. 67.

treating of Induction and Deduction, teach that only tautologies are perfect judgments.

24. The reader was perhaps somewhat startled at finding, in § 14, the notion of a subject with variable predicates pronounced to be a fallacy. Because for the verbal expression of a judgment we require a Subject and predicates, a Thing for the affirmed relations or qualities, a Substance for the attributes, there has arisen the belief in a corresponding real distinction. But the arguments which have shown that the Thing apart from its Qualities is a sheer abstraction, will suffice to show that the Subject is nothing more than the abstract expression of all the predicates, and therefore must vary with these. We may detach any one of these qualities from the rest, and so regard the abstract remainder as one subject, and the detached quality as the predicate; or we may generalise the group of qualities, and form an abstract class—say that of Plant, or European—and detach from this class any one individual, which will, because it is individual, vary somewhat from the others. We may thus say the Plant, the European, has such and such qualities; but these are invariant. If we find that any particular Plant or European has variable qualities, it is because we have substituted a particular for a general subject. The abstract generalised Plant may in its wide embrace contain plants that are fragrant and plants that are not fragrant, monœcious and diœcious, endogenous and exogenous plants, plants with stems and leaves, and plants with stems and no leaves, and plants with neither stem nor leaves; but it is a fallacy which concludes that any subject which is specified can have other than invariant predicates. For predicates—

qualities—are not mere patterns *on* the web of a subject; they are the *threads of that web.**

25. It has been ingeniously argued by Mr George Bentham, and elaborately wrought out by Professor Jevons, that Judgment is always the equation of subject and predicate. But since the subject is admitted to be a group of many predicates, since a thing has many qualities, how are we to admit that a thing is identical with any one of its qualities? If the orange is a group of sensible qualities, and is thus a subject to which the predicate yellow or acid-sweet may be assigned, how—it may be asked—can this one quality be the equivalent of all the rest, so that we can say the orange *is* acid-sweet—the subject *is* this predicate? The difficulty arises from our substituting an abstract conception in place of the concrete perception. All *that* is felt in the concrete is the acid-sweet taste *following* a particular sight and touch. The object tasted is—the object tasted. We travel beyond the immediate fact, and reach its predecessors; and we travel beyond these, and reach the store of previous experiences, grouped into symbols: but it is not *this* ideal orange which is the subject of the predicate "acid-sweet."

How it is that, ideally, we group a multiplicity of qualities as one, and regard any single quality as the equivalent of the rest, may be rendered intelligible by that law of Statics which has already been cited;

* "Das Subjekt hat erst im Prädikat seine ausdrückliche Bestimmtheit und Inhalt; für sich ist es deswegen eine blosse Vorstellung oder ein leerer Name."—"The subject first receives its specific character and meaning in the predicate; till then, it is, in itself, a mere name."—HEGEL: *Encyklopädie*, § 169. We may call the subject the unknown quantity, of which the predicates are the functions.

namely, that in any system of forces in equilibrium, no matter how numerous these forces, how various their directions, *any* single force is the equivalent of all the rest. Were it not so, the system could not be in equilibrium; and since the removal of any single force will destroy this balance of all the forces, it is obvious that any single force suffices to balance the forces which otherwise would have a resultant. Do we therefore affirm that, because in this one relation a single force is equivalent to a multitude of various forces, in *other* relations the same equivalence exists? By no means. We have specified the relation in which the equivalence obtains. In this relation many forces are condensed into one—mathematically they are one—having one *resultant*. To balance this resultant, an equivalent force in the same line and in the opposite direction is requisite; and any force which, acting in this line and this direction, suffices to balance the resultant, is an equivalent.

26. The mathematician condenses many and various forces into one resultant, without prejudice to their several values, or to the operation of such values in *other* relations; so the logician condenses many Predicates into one Subject, without prejudice to their several values in other relations; and any one of these Predicates is the equivalent of all the rest when detached from the group; and the group *minus* this one element then stands for the Subject. To the Taste, the group of sensible qualities named Orange *is* acid-sweet, and it is nothing else. To the Sight, the group is yellow and spherical, but not acid-sweet, nor rough and firm. To the Touch, it is rough and firm, not yellow nor acid-sweet. Thus the Subject is either

each of these Predicates by turns, or it is the incorporation of all of them. The equilibrium of a system is either that of two forces, or the incorporation of all the forces.

27. A Predicate is a Subject *specified:* it is what is said or thought in particular of a group of particulars. Both are groups of neural units, which, by the process of inclusion, form one group. When a single sensation is felt, and there is at the same time no larger group present to Consciousness which we can assign as the Subject—when the cause of the sensation is therefore unknown—we still follow the law of predication, and assign this sensation to a vague "Something." The sensible quality is then the Predicate, which specifies the otherwise unknown Subject, being all we know of the Subject. Now, why must *this* law of predication operate? Why can we not prevent thought from passing to an antecedent? Why must we in every case regard a sensible quality as forming an integral portion of some group of qualities? It is because Grouping is the process of Thought; and because Change, being the fundamental condition of Consciousness, necessarily involves at least two terms—a point of departure and a point of arrival.

CHAPTER III.

REASONING : THE SYLLOGISM.

28. THE one process which constitutes mental life is that of Grouping. We have just considered it under the aspect of Judgment. As the process of measuring is always the same whether the unit of measure chosen be an inch, a yard, a mile, or a semi-diameter of the earth, so the process of Grouping is the same whether the unit chosen be a neural tremor, a sensation or group of tremors, a perception or group of sensations present and revived, a conception or group of perceptions transformed into a symbol, a judgment, or a proposition which groups judgments. Reasoning—ratiocination—is not a different process from Judging, but the operation in the two cases is performed on different groups. A proposition *expresses* the identification of two terms—subject and predicate—in three terms, subject, predicate, and copula. A ratiocination is a judgment, the terms of which are two propositions; and the syllogism expresses this in three members—the major and minor premisses, and the conclusion, employing three terms —major, minor, and middle.

29. We made a distinction between a *judgment* and

a *statement*, or enunciation of the proposition; that is to say, between a judging operation, and the product of that operation stated in words. We must make a similar distinction between a ratiocination, and its verbal expression. The question may then be discussed whether the syllogism is the type of all ratiocination? and this again will raise the question, whether it is the true form of expression? The old logicians and psychologists regarded the syllogistic process as the process of reasoning. That opinion, although rudely shaken by moderns, still holds its ground, and has eminent supporters. We shall see presently that it is not the type of ratiocination—is no representation of the logical process; and that, however it may require three terms for its expression, a logical conclusion involves but two; for the conclusion is simply an inclusion, a judgment of which the terms are judgments. Reasoning is the same *process* as judging: it is a process of inference, inclusion. The process of judging has two terms only; the process of reasoning only two. As the copula identifies the subject and predicate, the conclusion identifies the major and minor premiss: it *resumes* what they have *assumed* and *subsumed*.*

30. Mr Spencer has argued that the syllogism requires four terms, not three; and it is certain that he thereby gives a more explicit form to the verbal process. His four terms, however, are condensed into two judg-

* Sir W. HAMILTON names the premisses respectively *sumption* and *subsumption*. The general term, or major premiss, sums together all experiences; the particular term, or minor premiss, is subsumed under it. Hence the conclusion (inclusion of the two in one) may be called the *resumption*, since it reasserts in one expression what has already been asserted in two.

ments in the logical process. A little consideration makes this evident. We do not think in this form—"All men are mortal; Mr B—— is a man, *therefore* Mr B—— is mortal." No one ever thought that. The process is: Mr B—— is what man is, and man is mortal. Each of these terms may require interpretation, but that is another process; the inclusion of the one group in the other is all that constitutes the act of reasoning.

31. To see how far the syllogistic process exhibits what takes place in the logical process, let us glance at a familiar illustration.

Two boys on entering a fruiterer's shop are told that all the pears and apples there exposed for sale cost a penny each. Charles selects one pear and one apple, and puts down twopence. Harry selects a peach and puts down a penny. Remonstrance of the fruiterer! Charles reasoned correctly; but did his mind pass through a syllogistic process of three terms? He did not say to himself, "All the pears and apples are a penny each: this is a pear, and this is an apple .·. each costs a penny." This is what he might have said to the fruiterer, or to Harry, in case of any dispute; this is how he might have *justified* his reasoning; but this was not the process of his reasoning. That process was the seeing of ratios—ratiocination. The ratios were given in the "all" and "each." No doubt having arisen respecting the import of the terms, the pear and the apple selected by him being admitted among the objects denoted by the *all*—the statements that all cost a penny each, and that each of the all costs a penny, are equivalent. Of precisely the same kind is the statement

respecting Mr B——, the man, as one of the "all" of mortal men.

32. But Harry, who has laid hands on a peach, reasoned incorrectly. His paralogism consisted in the substitution of terms; but the *mental operation* on these terms was the same as that in Charles's mind. To him, as to Charles, the "all" included "each." His intuition of ratios was subjectively correct, though objectively false. He included in the "all" what the fruiterer's terms excluded. And the use of the syllogistic form which enabled Charles to justify his intuition by rendering the terms and their ratio conspicuous, enables the fruiterer to point out to Harry the objective incorrectness of his intuition. But this process of justification is not the process of reasoning. That reasoning process is the same, whether its results are true or false; just as an arithmetical operation of multiplying one number by another, and dividing the product by a third, is the same operation, whether the result reached be correct or not; for the correctness of the result depends on the values of the terms, not on the process; the proof of the correctness or incorrectness of the product, objectively considered, is ascertained by another operation, rendering conspicuous the values of the terms.

33. Writers on Logic declare that the conclusion is simply a writing out of the premisses, or a *shutting in* (*conclusio*) in one expression what the premisses express. But they also declare that no reasoning has been effected unless the conclusion brings with it something new, something *not* in the premisses. This establishes a difference between reasoning and syllogising which they ought to take note of, but do not.

Was it an operation of reasoning when the dandy summed up in one expression his two separate statements: "I went there, and my brother went there; in fact, we both went there?" or is it an operation of reasoning when the geometer, after showing that the three sides and angles of two triangles are respectively equal, concludes that the two triangles are equal? Both of these may be thrown into that form of the syllogism which exhibits Mr B—— as mortal, because he is a man, and men are mortal. There is no third judgment in these conclusions; nothing is added to the premisses. But according to most writers the introduction of something new is an essential character. Thus Archbishop Thomson writes: "When the state of our knowledge does not warrant us in judging at once whether two conceptions agree or differ, we seek for some other judgment or judgments that contain the grounds for our coming to a decision. This is called reasoning, which may be defined the process of deriving one judgment from another. The technical name for that process is syllogism. It has been (defined by Aristotle), 'A sentence or thought in which, from something laid down and admitted, something *distinct from what we have laid down* follows of necessity.' The form or essence of the syllogism therefore consists not in the truth of the judgments laid down, or of that which is arrived at, but in the *production of a new and distinct judgment*, not a mere repetition of the antecedents, the truth of which cannot be denied without impugning those we have already accepted for true." *

* THOMSON: *Outline of the Necessary Laws of Thought*, 1869, p. 144. "A syllogism," says Mr MANSEL, "is a combination of two judgments

To the same effect Mr Mill, who refuses to admit as cases of reasoning at all, much less as cases of the special form of syllogism, any but those "in which we set out from known truths to arrive at others really distinct from them." He declares against the whole of ancient Logic, which was grounded on the *dictum de omni et nullo*, and proclaimed as its first principle that "whatever was true of a class was true of every individual in that class;" or (this being ambiguous, since much that is true of an army is not true of individual soldiers), as it may be more precisely worded, "Whatever is true of all the individuals of a class is true of every individual in it." This being an identical proposition, is by him set aside, and replaced by what he regards as the real axiom—namely, "Whatever is a mark of any mark is a mark of that which this last is a mark of;" or to slightly vary the formula: "whatever possesses any mark possesses that which it is a mark of." This, he remarks, strikingly resembles the axiom, "Things which co-exist with the same thing co-exist with one another."

Agreeing with all that is said respecting identical propositions not being reason*ings*—although they are *reasons*,—I cannot agree with this assertion respecting the new and distinct truths reached by Reasoning. No truth is *reached* by Reasoning; it is *inferred*; and this inference requires Verification. An identical proposition does not *exhibit* the process, but is a *test* of the product. Unless Reasoning can be reduced, by exhibition of the equivalence of its terms, to an identical proposition, or series of such, it is and must re-

necessitating a third judgment as the consequence of their mutual relation."—*Prolegomena Logica*, p. 69.

main mere Inference—mere picturing of what *may be*, or *might be*, presented to Sense or Intuition. But surely what is pictured is nothing, strictly speaking, new and distinct? It is the old image which we reprodnce. What is new and seemingly distinct from former experiences is the particular object to which we apply our old experience. If all mammals *are* lung-breathing animals (an inference), and if all whales *are* mammals (an inference), then the conclusion that this whale thrown upon our coast breathes with lungs is the rational inference, which simply re-states in particular what the premisses state in general; and on the assumption that the premisses are absolutely true, the conclusion is absolutely true, since it is the identical proposition, "A lung-breathing animal breathes with lungs." Nothing "new and really distinct" has been inferred; but in so far as the particular whale is a new *object*, not hitherto examined, there has been an application of old knowledge to an *untried case*.

34. Let us take a less obvious example. The experience of naturalists has established the general proposition that all vertebrates have separate sexes. This has been found to be true in thousands of cases, with no contrary instances. The proposition is therefore a registration of the observed facts; so that whenever we meet with any individual vertebrate, we necessarily conclude it also to be single-sexed, because we class it beside the known vertebrates. I catch a fish: I judge it to be a fish because it presents the characters assigned to fishes: I judge it to be a perch because it presents the characters assigned to that group of fishes, although with these it also presents certain characters

not found in all perch, but found only in the perch called *serranus*. Before proceeding to dissect this *serranus*, I have judged (concluded) that it is a perch, a vertebrate, and single sexed. Perch = vertebrate, and vertebrate=single sexed. I am persuaded that this individual is either male or female, cannot be both; but I do *not* form this judgment by deducing it from the general proposition "all vertebrates are single sexed." I may *justify* my conclusion by such a reference to the general register, should any one doubt it, but my conclusion was not founded on this; it was *included in my recognition* of the object. Had not the characters which determined my judgment that this object was a fish included the character of unisexual organs, I should not have pronounced that this fish must be unisexual. The whole strength of the general proposition depends on its expressing what is true of every individual in the class. This is apparent when, on dissecting the *serranus*, I find, to my great astonishment, that *it* is bisexual,—both male and female organs are present, and both normally constructed. My conclusion therefore was erroneous, because unwittingly I had assumed homogeneity in the terms, and had supposed the *serranus* to belong to the class of single sexed animals, because it belonged to the group Fish, of the class Vertebrate. This was the error of Harry, who supposed the peach to cost one penny because it was one of the class Fruit, and in many respects resembled the pears and apples which were said to cost one penny each. Henceforward, whenever a vertebrate is in question, I shall say: All known vertebrates, with the exception of a peculiar kind of perch, are single sexed; this animal before me is a vertebrate, and if it is not

one belonging to the exceptional class, it must be one belonging to the unisexual class. We must never forget that a fish is unisexual or bisexual because its structure is what it is, and not because the structure of other fishes, or of vertebrates in general, is this or that.

35. I am walking with a friend in the garden, and we see a moth alight upon a flower. He exclaims, "What a beautiful butterfly!" Whereupon I remark, "That is not a butterfly; it is a moth." If he asks me how I know that? the answer is, "Because butterflies, when they alight, close their wings *vertically*, moths expand them *horizontally*." Here it may be said that I have inferred a particular case from the general law. Yet although this is a convenient mode of stating that a certain characteristic has been observed among the differentiæ of moths, I did not, in judging that this insect was a moth, refer back to the general law: the visible characteristic of expanded wings was the one among the many visible characteristics by which I had been accustomed to recognise a moth, and any other would have served my purpose.

36. To decide whether the syllogism truly represents the logical process, we must first make clear to ourselves what the process of Reasoning is. I think the great source of obscurity in the writings of philosophers on this topic is, that they have not studied the Logic of Feeling, but have gone at once to the Logic of Signs. To understand what Reasoning is, we must first see it in animals. When a dog hears his master shout at him, or sees any one threatening him with a stick, the process in his mind which con-

auditory and visual feelings with anticipated

feelings of pain, and thus impels him to run away, is surely the process we name Reasoning. The anticipated pain is a conclusion shut up in the sensible premisses with logical precision; yet no one imagines that the process here is one of referring these particulars to a general law, and inferring from this general law a singular conclusion. When the dog sees the uplifted stick, he infers the impending pain, precisely as, when I saw the perch, I inferred its unisexual structure. The dog cannot justify his fear, as I can justify my inference; he cannot, as I can, express the process in a syllogistic form; but neither he nor I thought under the syllogistic form.

37. The distinction between reasoning and syllogising is the distinction between judging and enunciating—between an inference and a fact. The act of reasoning always carries some inference with it. I judge a white object to be sweet, when the sight, recalling experiences of taste which formerly accompanied it, enables me to infer that those feelings will again accompany it; but no sooner is this inference reduced to sensation, than all judgment in this matter is at an end. I taste the object as sweet, I do not judge it to be sweet. The same with reasoning. I conclude that the perch is single sexed, or the whale a lung-breathing animal, before examination; and can state in a syllogistic form the grounds of my conclusion, which grounds may require verification, or may be intuited as exact; but after examination and intuition there is no longer any reasoning, there is only a reason in the form of an identical proposition. Its expression, whether syllogistic or otherwise, is the statement of what was inferred, not the process of inferring.

De Morgan says that "all reasoning which cannot be made syllogistic is not reasoning at all, and that which cannot be made syllogistic is absurd;" nevertheless, in spite of this peremptory dictum, he has himself elsewhere given examples of reasonings, logically unassailable, which cannot by any skill be thrown into the syllogistic form. Mr Spencer has shown that there are "simple deliverances of reason and complex deliverances of reason, both of them having the highest degree of certainty, which are entirely extra-syllogistic—cannot, however violently dislocated, be brought within the syllogistic form. Consequently, if it be admitted that a true expression of the ratiocinative act must be one applicable to all acts, it must be concluded that the ratiocinative act is not truly represented by the syllogism." The fierce disputes respecting the value of the syllogism are to be reconciled only by ceasing to regard it as more than one mode of enunciating the rational grounds of a conclusion; and this has been satisfactorily shown by Mr Mill.*

38. The common fallacy that a conclusion is something more than an inclusion, that it brings a new and distinct truth forward which was not already contained in the premisses, has had disastrous effects in Speculation; it has led to that overweening confidence in the Deductive Method, which seemed to justify the hope of making discoveries in Physics and Metaphysics by *à priori* reasoning. We cannot too often insist on the fact that Reasoning alone never

* Comp. also JAIME BALMES: *El Criterio*, edicion 3, p. 162. "No negaré que estas formas dialécticas sean utiles para presentar con claridad y exactitud el encadenamiento de las ideas en el raciocinio: y que si no valen mucho como medio de invencion, sean à veces provechosos como conducto de enseñanza."

discovered anything;—at the best, it can only point to the place where we *may* find what is sought. To find it, we must look there. A finger-post is not a telescope.

We shall presently have to consider this in all its bearings; meanwhile, in defence of the over-estimate of Reasoning, and in confirmation of the belief that symbols are a vast extension of our powers, and that the clear and careful enunciation of the grounds of a conclusion often suffices to render its truth or error evident, we must admit that although a conclusion is always implicitly in its premisses, it is not always explicitly there, and a middle term may be used to point out this inconspicuous relation.

Thus, although the particular fact that apple-juice will redden blue silk is contained in the general fact "all acids redden all vegetable blues," it is by no means a conspicuous truth that the child who is peeling an apple will stain her blue silk frock, if she allow the juice to fall on it. The child's father may have learned—by hearsay—the general property of acids; but he does not foresee the staining of the silk dress, because he does not know that apple-juice is an acid; or if he has once known it, he does not now recall it. Not having therefore a mental vision of the properties of apple-juice, he does not foresee the staining of the silk. If, however, he has learned the general fact, and we further point out to him that apple-juice is acid, he will then and there see the conclusion which is contained in the premisses—that is, in the apple-juice and blue silk. No sooner does the wife come in than she sees the frock to be in danger. She has no such major premiss: "Acids redden vegetable blues"

to guide her; but she has some particular experience that apple-juice did on a former occasion stain a frock; and without pausing to inquire whether this effect had been due to any peculiarity in the apple, or to any peculiarity in the stuff of the frock, she at once *sees* the frock of her daughter in danger of being stained by this apple; she reproduces (because she cannot help reproducing) her former experience; and concludes (infers) that the cases being similar, the result will be similar. She sees mentally what will objectively be visible when the juice touches the stuff. Her husband would have seen it likewise had he mentally seen that apple-juice contained an acid. But both her conclusion from a particular experience, and his from a general law registering thousands of experiences, can only be valid on the supposition that the terms of the conclusion are what they are assumed to be. His terms are "acids" and "vegetable blues" under certain conditions. Her terms are an "apple" and "a frock," assumed to be of similar nature to those of the former experience. Their conclusions are rigorously exact when thus limited, and both may be rendered false by the presence of some slight condition overlooked, namely, a "dressing" in the silk of the frock which prevents the combination of the acid with the pigment. The conclusion of both runs thus: Whenever acids combine with vegetable blues the colour changes to red; this is a fact observed. There is an acid, and here a vegetable blue; the fact formerly observed is now inferred, and the *combination* being foreseen, the mental vision of the fact about to be realised is said to be a conclusion. This conclusion is not a *new* fact, but the old fact. What

is new is the case to which the old experience is applied.*

39. Claude Bernard has narrated the history of his curious discovery, that all animals, when fasting, are in the condition of carnivora, that is to say, they feed on their own flesh. A rabbit brought to him from the market was found to have clear and acid urine. The observation was casual and surprising. It contradicted all the registered experience which declared the urine of herbivora to be turbid and alkaline. Here was a vegetable-feeder with the urine of a flesh-feeder. Had previous observers been careless, and was the law erroneous? or was this rabbit not one of the herbivora? "En voyant l'urine acide chez les lapins," he says, "je me suis demandé instinctivement quelle pouvait en être la cause. L'idée expérimentale a consistée dans le rapprochement que mon esprit a fait spontanément entre l'acidité de l'urine chez le lapin, et l'état d'abstinence que je considérai comme une vraie alimentation de carnassier." † A less sagacious observer would have passed over this fact of acidity, or vaguely attributed it to some accidental cause; but in Bernard's mind the idea of acid urine was *included* in the idea of animal food; and there were to him but two explanations which reconciled this general idea with the observed fact: either this rabbit had been fed on flesh, and for the time had ceased to belong to

* "Cuando el hombre discurre no anda en actos reflexos sobre su pensamiento. Se presenta una idea, se la concipe con mas ó menos claridad; en ella se ve contenida otra, ú otras; con estas se suscita el recuerdo de otras, y así se va caminando con suavidad sin embarazarse á cada paso con la razon de aquello que se piensa."—BALMES: *El Criterio*, p. 158.

† CLAUDE BERNARD: *La Médicine Expérimentale*, 1865, p. 268.

the vegetable-feeders; or it had been kept from food altogether, and had been forced to use up its own flesh to sustain its heat, &c. On proceeding to verify these conclusions, he found the latter to be the true one. This once established, we see that from the general proposition—"All animals feeding on flesh have acid and clear urine"—he might have concluded that this rabbit, not having vegetable food, yet requiring food to sustain organic life, must feed on its own flesh, and being thus brought under the term "flesh-feeder," was at the same time brought under the term of "flesh-feeder's urine;" and the conclusion, "This rabbit must have acid urine," would be simply the expression of those terms, the specification of this rabbit as one included in all flesh-feeders. The discovery, though new and important, was nevertheless nothing but a disclosure of what was contained in the terms.

40. Reasoning is always an Inclusion, with its correlative Exclusion. It includes like with like, and excludes the unlike. The truth or error of the conclusion has nothing to do with the process, which may be as perfectly logical in arriving at an absurdity as in arriving at truth. Hence the vanity of relying on Reasoning when its merely logical conditions are complied with, unless at the same time the conditions of Verification are complied with.* What is known as false reasoning is not a process distinguishable from true reasoning; it is simply a classification of relations which are not objectively (*i.e.*, when felt) what they are assumed to be (ideally repre-

* HEGEL justly remarks that by means of a middle term anything may be syllogistically proved.—*Encyklopädie*, § 184. The vanity of Formal Logic as a means of demonstration has caused it to sink into neglect.

sented). The conclusion, logically true, since it shuts in its premisses, is really false, since the premisses *mis*-represent the real relations. We have formerly described the process as one of "mental vision, which reinstates ideas and images in the order their corresponding sensibles would assume. A chain of reasoning, however involved, is nothing but a series of inferences—ideal presentation of objects not actually present to Sense. Could we *realise* all the links in the chain, by reducing conceptions to perceptions, and perceptions to sensibles (and this would be effected by placing the corresponding objects in their actual order as a sensible series), our most abstract reasonings would be a succession of sensations."

41. Although inference thus is the very root of Reasoning, there are manifest differences in the degrees of certainty of our inferences,—from irresistible conviction down to mere hypothesis. It is always and everywhere a representation of what we assume would be a presentation were sensibles to take the place of symbols. The validity of this assumption is in some cases indisputable, and then the Ratiocination is equivalent to a verified Perception; and the conclusion is then the expression of an identical proposition. In most cases, this assumption is more or less disputable, and cannot be tested. In default of the needful tests, we rely on the probabilities of Induction and Deduction, which—contrary to all that logicians teach—we shall find to be *always* and essentially the logic of probabilities.

CHAPTER IV.

INDUCTION, DEDUCTION, AND REDUCTION.

42. HAVING described the two operations by which the materials of Sense are transformed into objects of Science, and by which our Cosmos is ideally constructed, we have now to inquire by what procedures the mind advances from the Known to the Unknown. They are chiefly Induction, Deduction, and Reduction. The two first are methods of Search, the third is a method of Proof. The two first extend knowledge by generalising acquired results, and applying these to new occasions. The third criticises these results—retraces their formation step by step, displays what are the judgments included in the propositions, and what are the feelings included in the judgments—thus reducing inferences to sensations. In this critical revision, the symbols are made to declare their significations, and the propositions have to exhibit their assumptions. For example: Experience has told us that many alkaloids are poisons. If from this we form the induction that alkaloids are poisonous, it is obviously because we connect the two ideas together, and include the idea of poison in the idea of alkaloid. The induction thus obtained is simply the inferential extension of known cases to all

cases *assumed* to be of the same kind; were it not for the assumption of homogeneity, we could never extend our experience; and were this homogeneity *certain*, the extension would cease to be inductive and become intuitive: it would then be an identical equation. Either the induction or the intuition will furnish Deduction with a basis of operation. In the first case, the deduction will need Verification, because the equation is an equation of condition, and is only true *if* the induction be true; in the other case, the deduction is an intuition of equivalence, and, as such, absolutely certain. Thus, if the induction be true, and *all* alkaloids *are* poisons—which can never be proved, since the proof would require reduction of the general proposition to every particular instance, and we could never be certain that every alkaloid had come under our notice—the deduction that any one alkaloid is a poison must be accepted as the specification of a general truth; it is the assertion that this *one is* what *all are*. Confiding in this deduction, which rests on the validity of the previous induction, we treat every substance which presents the alkaloid characters as if it were already proved to have poisonous characters; but on testing this conclusion by experience, we find that there are substances possessing the alkaloid characters without the poisonous characters. Henceforward we rectify our induction, and hesitate before inferring poisonous characters co-existing with any untested alkaloids. Alkaloids we find to be substances agreeing in their class characters, but differing in other characters. We inquire, therefore, whether the poison characters are included in the class characters, or lie among the differentiæ? So

long as no alkaloid was known which was not poisonous, the inference pointed to the class characters as including the determinants of poisoning; but this inference was set aside when alkaloids not poisonous were discovered, and when it was remembered that there are other poisons besides the alkaloid.

INDUCTION.

43. Induction is an inferential process of extending our Experience by representing the unseen and untried as equivalent to the seen and tried. When, from several experiences more or less resembling each other, we infer that what has happened once will happen again, it is because we silently assume that in the new cases there will be a repetition of the old causes. To infer that because one thing resembles another in one quality, it must resemble it in all qualities, would be too flagrant a contradiction of universal experience; but to infer that it has the quality which was observed in some other thing outwardly resembling it, is simply to infer that this quality always co-exists with these visible qualities; and to test this inference we must reduce it to sensation. *So long as it remained untested inference, it was an induction;* when tested and verified, it ceased to be an induction, and became an identical proposition, the simple enunciation of what had been observed.* If we conclude from the some to the many, and from the many to the all, this is only valid on the assump-

* The reader will see the points in which my exposition agrees with, and departs from, the ingenious argumentation by which Professor JEVONS, in his recent work, *The Principles of Science*, 1874, vol. i. p. 139, endeavours to show that induction is in all cases an inverted deduction.

tion that the some, many, and all, are homogeneous, at least in the relations included and concluded.

44. I place the two poles of a battery in a vessel of water, without any express purpose beyond that of seeing what will result. Presently oxygen gas is found bubbling up from the one pole, and hydrogen gas at the other; all this while the water is gradually disappearing. Here is a fact unique in my experience, and I cannot include it in any general fact known of water. Nevertheless, I am justified in affirming an universal law—namely, that always and everywhere, under precisely similar conditions, water will disappear, and oxygen and hydrogen will appear. The only doubt is, whether I shall elsewhere be able to reunite all these determinant conditions; and my induction, which applies past experience to cases exactly similar, imagined as presenting themselves in the future, is an inference because of the doubt. Remove that doubt, and the induction gives place to an identical proposition.

45. The whole procedure of the chemist is dictated by the recognition of the truth that identical results only follow identical *co-operant* conditions. Hence his experiments are conducted with the view of eliminating disturbing causes. He operates *in vacuo*, or under conditions of temperature and atmospheric pressure which are rigorously determined; he operates upon substances as pure as may be, the composition of which is defined, the properties known; he assures himself, so far as possible, that he has got rid of all heterogeneous elements, or that he has ascertained the value of all the co-operant conditions. On this ground he is enabled to establish general conclu-

sions from single experiences. Off this ground his conclusions, although suggested by a thousand experiences, are never more than probabilities and inductions. When Davy found that he could extract a metal from potash, it was a natural inference that soda, which in many respects resembled potash, would also resemble it in having a metallic base. The inference might have been wholly wrong. The metallic base might have been one of the differentiæ of potash. But when soda was found to yield sodium, as potash yielded potassium, the inference that other alkalis contained metallic bases must have occurred to every mind. This also might have been rash. Only verification could raise it into a law. When experience had shown that one after another the alkalis and earths had metallic bases, the induction was gradually strengthened, till at length there only remained one known exception, that of ammonia. Such is the coercion of a wide induction, that chemists could not bring themselves to believe that there was not a metal, ammonium, present in ammonia also, although it baffled their efforts to isolate it. A metal *is* there, but not the metal chemists sought. Graham's discovery of hydrogen, as a metal in the gaseous condition, besides the many other important views which issue from the discovery, completes the inductive generalisation, and removes the one known exception to the law. At any stage of the inquiry short of this last stage, the mental process might have been thrown into this form: Potash is an alkali: potash contains a metal ∴ alkalis contain metals. This conclusion of a general from a particular, although the normal process of reasoning is no true syllogism; it does not express what

is tacitly assumed—namely, that all alkalis are homogeneous in nature, and therefore that what is true of one is true of all, as what is true of one equilateral triangle is true of all equilateral triangles. This assumption of homogeneity, however, needs confirmation. When soda, and other alkalis and alkaline earths, had yielded their sodium, barium, aluminium, &c., the needed confirmation was approached; and now hydrogen is discovered to be a metal, we may express the series in a perfect syllogism: All alkalis contain a metal: this is an alkali .·. this contains a metal.

Or take a parallel case: We hear of some ferocious act committed by an Asiatic. The connection of the idea of ferocity with the idea of an Asiatic is established in our minds. At the street-crossing stands a Lascar, broom in hand; instead of rewarding him with a penny for sweeping the road, we pass him with a suppressed shudder, because the sight has recalled the idea of ferocious Asiatics. The judgment, though precipitate, is inevitable, if what we have otherwise known of Asiatics is not corrective of it. We judge as Davy judged when he found potassium in potash. Had no one found sodium in soda, and aluminium in clay, Davy's inference would have been vague hypothesis; had they found in soda and clay elements which contradicted the presence of metals, excluded them, the hypothesis would have been rejected. In like manner, when quitting the Lascar, we call upon a friend, and there meet with some cultivated Hindu, or some pious Parsee, and learn what gentleness, benevolence, and beautiful morality characterise their lives, we rescind our judgment respecting the ferocity

of Asiatics, and say simply: "That Asiatic was ferocious," or "Some are ferocious." Our former judgment is excluded by the fresh experience: it is made to include no more than the case on which it was founded, or to include only that and all such as are homogeneous with it.

46. The necessity of verifying our inductive inferences is forced on us at every step. Thus nothing seems more justifiable than the induction that since the temperature of a pound of water at 39° F. is raised one degree by a unit of heat, therefore two units of heat will raise it to 41° F., or, more generally, "that the temperature will uniformly be proportional to the units of heat applied." The inference is, however, here inexact. Experiment shows that, as the temperature of water rises, *more* heat is required to raise it one degree. Again, we observe that the temperature of the earth increases as we descend into its interior; and we conclude that at a certain depth it must be equal to that at which most stones melt in our furnaces; but the inference that the stones must be melted at these depths, though one which immediately forces itself on the mind, may be and probably is erroneous, because founded on an assumption of uniformity which, on reflection, we see to be insecure, for we know that the rocks at these depths must be under such enormous pressure that they probably may remain solid in spite of the enormous heat.* It was by a similar induction that life was supposed to be impossible at great ocean depths; the enormous pressure of the superincumbent water (together with the absence of light

* Compare, however, on this doubtful point, THOMSON and TAIT: *Natural Philosophy*, i. 725.

and heat) seemed to render life impossible. Yet we have now ample evidence of abundant life at depths of three thousand fathoms.

Inductions are probabilities when they express more than identical propositions. If our examination of metals one after the other has displayed the property they have in common of conducting electricity, and this observation has in no case been contradicted, we formulate the law, "All metals conduct electricity." Strictly speaking, all that we are certain of is, that all *known* metals, so far as they have been examined, conduct electricity.* Again, our examination of various objects,—metals, woods, liquids, gases, &c.,—has taught us that they expand when heated; we formulate this as an inductive law of objects. But on heating stretched india-rubber, and one or two other substances, we find contraction, not expansion, results. The expression of the induction has therefore to be limited. We find that water, at a temperature of 212° F., becomes less and less in volume, as, degree by degree, the temperature is lowered. After observing this *series* some hundred and fifty times, without meeting a single variation, we naturally conclude that the contraction of the water must continue with every reduction of temperature, and in the exact ratio of the reduction. This is a good induction. But on reaching the 40th degree there is a change in the phenomenon—the water expands instead of contracting.

* Comp. HEGEL: *Encyklopædie*, § 190.

DEDUCTION.

47. Induction is the application of a fact observed in one or several cases to the whole of the unobserved cases, which are assumed to be of the same or of similar kind. In this assumption of an identity amid diversity, this inference that what *has* been found to co-exist with certain characters *will* be found elsewhere to co-exist with similar characters, lies the whole reach of Induction. No sooner is that assumption changed into a certainty, than Induction ceases, and gives place to Intuition of equivalence, the expression of which is an identical proposition. Consequently Induction can never be more than a more or less probable guess. It is not *knowledge* * until it ceases to be inductive by the verification of each of its applied inferences.

Is Deduction less inferential? By no means. It is the inverse process of inferring a particular case from a law of cases assumed to be of like nature, thus including the one specified case in the general group of the many or all: an inclusion which obviously demands proof, since this one case may not be one of those comprised in the general group. For example, there is the anatomical law, abstracted from millions of observations, that men and women have the liver

* Throughout this discussion the term *knowledge* is purposely limited to the certitude which excludes doubt. In ordinary speech, and even in philosophical speech, it often comprises conceptions which are acknowledged to be possibly erroneous, and we are said to know what indeed we only believe and infer; although even here it is only called knowledge when we consider that, if the grounds of inference were examined, they would justify the belief. There is, however, a marked distinction between knowing and inferring, between feeling and guessing; and, for the object of our present inquiry, it is necessary to keep this distinction in view.

on the right side, and the heart in the centre slightly inclining to the left; there is another law which assigns two breasts to each individual. From these inductive laws we deduce the conclusion that *any* man or woman will, on examination, present these anatomical details. The inference is of very high probability, but is only an inference, and only probable; and because of this we name it a deduction. In the course of actual Experience we now and then stumble upon cases which prove the conclusion at fault; we find human organisms in other respects similar to the organisms we have known, but having the viscera *transposed*; and (but more rarely) we meet with women having three, and even four, breasts.* Now, since it is impossible that we could ever know what is the structure of all human organisms, any assertion we may venture on respecting an unobserved organism must be hypothetical; and although we may rely on the deduction, owing to its great probability, we cannot be said to know what has not been proved, and may be erroneous. Our induction, "all substances expand when heated," if employed deductively to prove that this india-rubber will expand when heated, would manifestly lead to error. Unless the stretched india-rubber be one of the all, what is affirmed of the all cannot be affirmed of it; and if we assume it to be one of the all, this assumption requires verification.

48. The ordinary notion of Deduction fails to distinguish it from that of simple Intuition, or from the re-statement in a particular of what has been stated in

* Nay, there are authentic cases of even men with four breasts; and in one case there was an abundant secretion of milk, which had to be arrested by medical treatment. See *Journal of Anatomy*, 1872, p. 56.

general. It is said to be a conclusion from the all or many to the one; and this is correct, if we understand the conclusion to be a re-statement of the assumed inclusion—*i.e.*, if the one is assumed to be one of the all or many. But this assumption, which is the ground of the inference, the justification of the inclusion, is excluded from the type of Deduction presented in logical text-books as that of Perfect Deduction. I shall touch on this presently. Here it must suffice to say, that Deduction ceases when Inference is excluded, precisely as in the inverse process of Induction; both are guesses; both are applications of what is, or has been, to what may, or will be. If we have found that 2 + 2 = 4, we do not *infer* that whenever 4 is divided into halves each half will equal 2; we intuite it; there is no possibility of doubt when the terms are clearly seen. In like manner, when we have all the particular facts expressed in a general fact, the statement that any one of these facts is one included in the general fact, is not an inference at all, not a deduction, but an intuition: we see the relation in seeing the terms.

Deduction can only be certain through the intuition of the law, or, as I have termed it, through intuition of its invariants. We are certain that any numbers composed of three consecutive integers (*e.g.*, 123 or 567), and three figures in a progression by equal differences (*e.g.*, 579 or 159), are divisible by 3; we are likewise certain that all numbers ending in 5, being multiples of 5, are divisible by 5. But this certainty is not attainable simply by trying particular cases, unless we know that in each particular case the ratios are *in all respects* a repetition

of the one originally proved. We may have found that fifty different numbers ending in 7 are what is called *prime*; but we cannot conclude from these cases that *any* number ending in 7 is prime; we may infer it; but we soon stumble upon numbers ending in 7 which are not prime; and on then comparing the two sets we find that they are not similar throughout. The laws of our decimal scale are such that every number ending in 5 must be divisible by 5, because it is a multiple of 5. But the laws of number are not such that every number ending in 7 must be prime; because prime numbers are multiples only of unity, and there are many ending in 7 which are not multiples only of unity.

The application of a general expression to any one of the particulars it expresses is a tautology, not a deduction; the application to *new* particulars, not expressed but assumed to be identical, is deduction, because it is inference.

49. Here we meet with the common mistake of supposing that an axiom or general truth gives validity to any special truth inferred from it. The fact is precisely the reverse: the particular truths constitute the sole validity of the axiom or general truth, which condenses them in a brief expression; and any further inference needs verification to assure us that it does come within the formula. When, for example, we assert that Mr B—— is mortal, we do not affirm this as a derivative from the general truth, "All men are mortal" (although this is commonly implied, because any doubt raised respecting Mr B——'s mortality would be answered by the general statement); we affirm it because we believe

Mr B—— to be a man, and in our idea of man is included the idea of mortality. The truth that "all men are mortal" is only admissible on the assumption that no men are included in the "all," save such as are of the same kind as those included in the class "mortal." We have no difficulty in imagining a man, resembling other men in every outward character, yet so peculiarly constructed that the waste and repair of his tissues should preserve a perfect balance, and that his body should be incapable of fractures, lesions, and other destructive changes—in a word, an organism which would not follow the universal law of other organisms, and would survive amid the ruins of its descendants. But by the very exclusion from the class designated, "all men," *this* man is not one to whom our general truth referred. If Mr B—— has such an organism, he is not one of the all men who are affirmed to be mortal. Further, when Mr B—— dies, it will not be *because* all other men resembling him have died or will die, but because Death is one of the cycle of phenomena constituting the individual existence of an organism which is momently dying. An unsupported body does not fall *because* Gravitation is a Law; it falls because there is a particular concurrence of conditions; and the Law is simply the generalisation of such concurrent conditions. If the unsupported body rise in the air instead of falling, this also is due to the concurrent conditions, and not to Levitation. In the same way one man dies not *because* of the Law of Mortality (which is abstracted from the particular facts of mortality), nor *because* other men die, but because Death is the terminal phenomenon in the series of vital phenomena. A man

dies—because the living organism is chemically unstable, and only living when its instability alternates with stability. The structure is for ever changing: assimilation of new material and destruction of the old are incessant; and among the consequences of this incessant change there are inequalities which lead to differentiations, and these finally to Death.

50. Not until we have ascertained the physiological conditions of Death, has the induction "all men are mortal" a probative character. As a matter of fact, we know that the idea of Mortality is one which rises late in human consciousness. The early races did not, and many savage races of the present time do not, believe in it; they believe death would never take place unless some evil-disposed demon, instigated by a witch or magician, exercised a spell. The disease which destroys an organism is held to be the action of this demon; and were there no such demonic influence, men would, they believe, continue for ever on their hunting-grounds.

CHAPTER V.

SOME ERRORS RESPECTING INDUCTION AND DEDUCTION.

51. To complete the foregoing exposition of the psychological processes, we must consider certain views expressed in works on Logic which are irreconcilable with its leading arguments.

In the first place, note the misleading phrase, "Induction passes from particular truths to general truths." We have seen that this is not so, but that Induction passes from particular truths or assumptions to an inferred correspondence between them and the untested cases which resemble them; and when these correspondences are proved, Induction ceases.

In the second place, note the classical division into Perfect and Imperfect Inductions and Deductions. Whatever justification there may be for this division in Formal Logic, it is certainly not justifiable in Psychology.

52. Induction is defined by De Morgan as "the inference of a universal proposition by the separate inference of all the particulars of which it is composed."* This use of the word *inference* is not the one adopted by me, but accepting it as equivalent to "conclusion," I still object to the definition, since it

* De Morgan: *Formal Logic*, p. 211.

does not express the mental process which takes place in what is called Imperfect Induction. Hamilton declares the division of Perfect and Imperfect Induction to be absurd, and will only recognise logical Induction as "that which infers the *whole* from the enumerated *all*." Mr Mill takes up the opposite position, and recognises only that which Hamilton and the generality of logicians call Imperfect Induction; and Mr Spencer takes the same view. "When, proceeding by the so-called imperfect induction," he says, "I infer from the many instances in which I have seen butterflies developed from caterpillars that all butterflies are developed from caterpillars, it is clear that the inference contains multitudinous facts of which I have never been cognisant; from a few known phenomena I conclude innumerable unknown phenomena. On the other hand, suppose I proceed by the so-called perfect induction, which does not allow me to predicate of the whole anything I have not observed in every one of the parts, and which therefore does not permit as logical the conclusion that all butterflies are developed from caterpillars; what will then be the course of my reasoning? It must be that as each of the butterflies (which I have observed) was thus developed, the whole of the butterflies (which I have observed) were thus developed; and here it is clear that the so-called conclusion contains nothing but what is previously asserted in the premiss—is simply a colligation under the word *whole* of the separate facts indicated by the word *each*—predicates nothing before unknown. See, then, the contrast between these two kinds of mental procedure. In the one, from something known something unknown is

predicated; in the other, from something known nothing unknown is predicated." *

Hamilton, indeed, might have replied that he had already parenthetically anticipated this objection when he said the "wholes were known by an enumeration (actual *or presumed*) of all the parts;" but unfortunately this very admission washes out the characteristic feature of his Perfect Induction, since the assumption of *likeness* in the inferred cases constitutes Induction as distinguished from Enumeration or Intuition; and this renders Induction precarious. If we begin by proving that all butterflies are developed in the way which those known to us are developed, there can be no Induction in the case; but we are debarred from this: except as an eminently probable supposition, we cannot prove it, because we do not know what is the fact regarding all butterflies; we are taught hesitation by our knowledge of the "alternation of generations," observed in certain classes of animals, which suggests that some butterflies not yet examined may possibly be developed directly from the egg, without passing through the caterpillar stage; just as medusæ are developed without passing through the polype stage, or as *salamandra atra* is born without passing through the tadpole stage (that is, not in the water, but in the womb of its parent).

53. The reader will see that Mr Mill and Mr Spencer are fully justified in wholly rejecting the division of Induction into Perfect and Imperfect; what is called by logicians Perfect Induction being simply what Hegel calls a tautological enunciation. Of this De Morgan seems to have had a suspicion when he

* SPENCER: *Psychology*, ii. 81, 2.

wrote: "Since it is practically impossible to examine all particulars, the statement of an universal from its particulars is only *probable*, unless it should happen that we can detect some law connecting the instances by which the result, when obtained as to a certain number, may be inferred as to the rest. . . . This *induction by connection* is common enough in mathematics, but can hardly occur in any other kind of knowledge." While I admit that the "induction of connection" is very serviceable in enabling us to classify what would otherwise remain doubtful, I neither admit that it can alter the inferential character assigned to Imperfect Induction, nor that it is exclusively the possession of Mathematics. We formerly saw (vol. i. p. 421) that the inductions of Mathematics have the same kind of contingency as the inductions of Physics or Biology.

54. Let us here consider an induction of connection in the analogical case instanced by Mr Spencer.* The growth of an individual organism is simultaneous with the subdivision of functions among its parts, and is like the growth of a society, which is simultaneous with the division of labour among its members. To many minds this analogy appears so faint and remote that it would not be admitted as a basis of argument; but to those who have fully penetrated the significance of its terms, it is a valid induction. This will be seen when, instead of the *growth* of the organism, we substitute the more precise expression the *development* or *differentiation* of the organism—a substitution necessary for the truth of the proposition, since obviously an organism may

* *Psychology*, ii. 76.

grow to an enormous size without any corresponding increase in the subdivision of its functions, but it cannot take on a differentiation without a corresponding difference in functions, the one fact being but the obverse aspect of the other. The same is true of the social organism; society develops as its structure differentiates. But it may be asked, Is there any real resemblance between an organism and a society? Is there more than a verbal parallelism? "The likeness," says Mr Spencer, "in virtue of which society is referred to the class organism is very distant; and there is not much apparent similarity between the progress of organic economy and that of industrial economy. Hence the inference might be considered but little more than an idle fancy, were it not inductively confirmed by past and present history." To this confirmation we may add that "induction of connection" mentioned just now; for we discover the law in detecting the similarity of the mechanical relations involved. Both in a machine and in an organism, division of labour and specialisation of parts effect results before unattainable, or attainable only in insignificant degrees.

55. Consider the contradictory statements which meet us on all sides, declaring, on the one hand, that perfect Induction and Deduction require a complete enumeration of all the constituents of each whole, and, on the other hand, that unless something unknown, new, and distinct is reached, there has been neither Induction nor Deduction, nor indeed any Reasoning whatever.

These assertions are flatly contradictory. If we already know every particular case which is expressed

in the universal case, we cannot be said to reach the *unknown* in our induction of the universal; and *vice versa* with our deductions. But if we do not already *know* what our inductions or deductions conclude, *these* conclusions can only be guesses, not knowledge; they require Verification—and this is neither the process of Induction nor of Deduction, but the process of Reduction.

56. For example, from the particular facts observed in the liquefaction of gases under great pressure and intense cold, we inductively conclude that all gases might be so liquefied; and we may deductively conclude that some one gas not hitherto experimented on will be liquefied if the due pressure be applied. This is a case of true induction and deduction. Each demands Verification before it can pass from a probability to a demonstration. In neither is there a *new and distinct truth reached*, but simply an *old truth* reproduced, and *applied to an untried case.* Here an "induction of connection" may greatly increase our confidence; for if by it we establish the fundamental law of liquefaction as dependent on molecular oscillations, and assume the molecules of gases to have a wider sweep than the molecules of liquids; and if, further, we can show that intense cold and pressure lessen this oscillating sweep, there will only then remain this final doubt: Is it within our power to so far overcome the molecular sweep of this particular gas that it shall be reduced to the molecular sweep of a liquid? So long as this question remains unanswered by the decisive experiment of liquefying the gas, our Inference remains a guess. When answered, there is no more room for Inference.

57. It thus appears that we are not justified in adopting either of the contradictory positions. We cannot admit Perfect Induction and Deduction to be processes of Inference, nor processes by which *new* and *distinct* conclusions are reached, if the perfect forms express nothing more in the conclusions than has already been stated in the premisses. On the other hand, we must also modify the position adopted by Mr Mill and Mr Spencer, in common with the logicians they oppose, namely, that "all reasoning, Inductive or Deductive, is a reaching of the unknown through the known; and where nothing unknown is reached, there is no reasoning." According to the principles we have laid down, nothing *new* is ever reached by Reasoning alone, but only by direct Feeling. Reasoning grasps at—infers—*re*presents under new circumstances what has already been presented under other circumstances more or less like them. It is a mental vision of the unseen by reproduction of the seen. Mr Spencer has himself expressly described the process "as a cognition of the likeness between certain before-known relations and certain relations not yet known by perception but represented by imagination." Should it be said that these not yet known relations thus represented by imagination are what is indicated as the *unknown reached*, I reply that the *supposition* of such relations being really present in the untested cases is supposition, not knowledge: we do not know that they are present; we infer it. Moreover, that which we infer is not an *unknown relation*, but an already known relation; and it is only the fact of its *presence* which is inferred. To determine the truth of this inference by submitting it to the test of Verification, and trans-

muting what was inference into sensation, is to pass from Reasoning to Feeling, from Inference to Knowledge.

58. It appears, therefore, incorrect to say, that Reasoning reaches the unknown through the known, unless we supplement the process by the very process of Verification of Inference which removes from Reasoning its contingency. In the majority of cases, Reasoning does not start from what is known, but from what is inferred or assumed. It is an inference from an inference when a politician argues that a certain measure will be passed, and the consequence will be such a popular agitation that a revolution will be attempted, and then, the soldiers joining the people, the monarchy will be destroyed. This is assuredly a series of inferences forming a chain of Reasoning; a mental vision of possible facts; but certainly not knowledge. It may be a true prevision of events; it may be a partially true prevision; it may be a wholly false prevision. The measure is not passed, or, when passed, does not produce the agitation inferred; or, if the agitation be produced, the troops do not join with the people, but fire on and disperse the agitators. It is obvious that the mental vision will have various degrees of probability, according to the grounds of the inferences, and these are sometimes almost equivalent to the absolute certainty of Feeling. Thus, if I have been bitten by a dog when I pinched its tail, I infer that the next time I pinch a dog's tail he will try to bite me; the probability, though great, is not a certainty: and I may find that the second dog, instead of biting me, howls and runs away. If I have weighed a packet, and ascertained

that it balances one ounce, I infer that this same packet will balance one ounce in any other scales. In this case, the conclusion is only an inference in so far as I am allowed to assume a possible difference in the scales, or a possible alteration in the packet; a little imperfection in one of the scales, or a little more moisture in the packet, will so far alter the absolute identity of the two cases that my conclusion proves inexact. I am then applying past experience to a new case which is assumed to be identical with the past case in the relations prefigured. Get rid of this assumption, and the two cases being identical, my conclusion is no inference, but an intuition. I have not reasoned; I have simply intuited that the two cases are identical, and that what the one is the other is. Now apply this distinction to my experiences with dogs. When I infer that the second dog will bite me, I assume that this dog, being similar in nature to the first, will act as the first acted: having no evidence to disturb this natural assumption, I treat it as valid; on testing it, the result proves that the two dogs were not identical in this relation. But if, looking away from facts, I choose to get rid of the contingency by generalising my experience, it is possible to replace Reasoning by Intuition; and I have then the identical proposition that under like conditions like results occur, under unlike conditions unlike results: this dog, and all dogs of identical dispositions, under identical circumstances, will bite when their tails are pinched.

59. According to our definition of Reasoning, it is the Logic of Feeling expressed in the Logic of Signs; and this accords very well with Mr Spencer's defini-

tion of it: "the classification of relations." But the classification must be understood to involve the necessary element of Inference. Unless we are allowed to consider every conclusion reached by Inference to be Knowledge—which would in many cases be palpably absurd—we cannot correctly speak of reaching the unknown through Reasoning; we can only say that by the aid of Reasoning we are guided in our search, and by it *re*-cognise known relations under somewhat different attendant circumstances. For each fresh step in Knowledge we require a new perception or a new intuition. What has once been seen may hereafter be foreseen; what has been felt may be inferred, applied to new cases, and to somewhat different cases. We see and seek. The search is tentative, and guided by Sense and Intuition. It ranges about the circle of things and relations already traversed by Experience, and out of this variety of experiences finally recognises the *likeness* which it seeks; and this act of classification of like with like, separating like from the unlike, is Perception in the Logic of Feeling, and Judgment and Reasoning in the Logic of Signs. A gossip, told that Mrs Brown was delivered of a child, was asked the sex; she answered, "Boy." "No: guess again." "Then it's a girl!" "Ah! somebody told you!" The successful Reasoning process of the gossip differs only in its symbols from that by which Kepler hit upon the elliptical orbit of the planets. She is told to guess the sex of the child—that is, ideally to represent what a sight of the child would sensibly present. She guesses Boy; no doubt because Boy was the most familiar to her thought, that being mostly the wished-for

sex. This guess failing, she falls back upon the facts of her experience, and having never heard of any other sex than that of male or female, at once *finds* the desired conclusion, just as Kepler found among geometric forms known to him none but the ellipse which would answer his question.

60. What is found may be what is sought, or something else, but this does not affect the nature of the seeking operation. It is possible to reason falsely, as to perceive falsely. The Intellect may have a clear vision of relations which do not objectively present that order; as the Sense may suggest a vivid perception of objects which are not then truly present in space. When I mistake an imitation for the object imitated, no one will say that I have not performed the normal process of Perception. When I miscalculate 9 + 7 as equal to 15, no one will say I have not gone through the normal process of Addition. When I conclude that a berry resembling other berries will, like them, please my palate, no one will say I have not performed the normal process of Judgment. All three operations require Verification. If the object perceived as an apple be successively submitted to my various senses, and at each step agrees with what apples have formerly been found to be, I have then traversed the whole ground, and my perception is demonstrated to be objectively true—it may be formulated by an identical proposition. So also with the calculation; so also with the judgment.

61. That the process of Reasoning is independent of the truth of the product may be seen at a glance. By contemplating the relations of angles we discover

that the internal angles of a right-angled triangle are equal to two right angles. Having once intuited this relation of equality, we now declare that this is true of all right-angled triangles. This is undoubtedly an act of Reasoning, but it is one proceeding on the assumption that *all* the triangles are of the same nature as this one—an assumption which has to be verified by exhibiting the generating conditions, or fixing what is here meant by the word *triangle*. If the generating conditions are supposed possibly to vary with variations in size, &c., or if the word *triangle* be allowed to include spherical beside rectilinear triangles, the conclusion will be false. The intuition is, What is true of one triangle here, is true of similarly constructed triangles elsewhere. But now contrast this intuition with an induction: Here is a man who has freckles on his face, and brass buttons on his coat .·. all men who have freckles on their faces have also brass buttons on their coats. "The conclusion is absurd, illogical, not an induction at all!" Absurd it may be, to minds that see its irrelevancy; illogical it may be, if only objectively true conclusions are logical; but it assuredly is an induction—an inference from the one to the all, proceeding on that very assumption of likeness which was the basis of the conclusion from one triangle to all triangles; and differing from that because it is without the "induction of connection," which would prove the relation between freckles and brass buttons to be a necessary result of the generating conditions. While we intuitively see that all rectilinear triangles are and must be identical, we do not see that all men must be identical in respect of the co-existence of freckles and brass

buttons. It is, however, quite certain that if a savage, on first meeting a civilised man, observed freckles and brass buttons as peculiarities in this stranger, he would inevitably infer that all the men of this tribe had these peculiarities.

62. Although Reasoning, as a mental process, is essentially independent of the truth (*i.e.*, objective validity) of the conclusions reached, there are many cases where the element of contingency involved in the inference is reduced to a minimum, and the certainty of the conclusion is little short of absolute. The relations classified are known relations, and the classification has ample justification. Yet doubt is not altogether excluded; otherwise the mental process is no longer one of Reasoning, but an Intuition of identity. The reader understands why this distinction is insisted on, although in ordinary language we habitually confound the two; and indeed much of what passes for mathematical Reasoning is not Reasoning at all, but Intuition. It is neither Reasoning in accordance with the current conception, which insists that in Reasoning something unknown must be reached; nor in accordance with the conception which insists on Inference as the essence of Reasoning. Take for example the demonstration of Euclid (XI. 18) of the proposition, "If a straight line be at right angles to a plane, every plane which passes through it shall be at right angles to that plane." This is not Reasoning at all, according to any accepted definition; no sooner are the terms clearly presented to the mind than the conclusion is intuited. We cannot mentally see a straight line at right angles to a plane without seeing that any plane passing through

that line will be a plane of such lines, and that what is true of the one is necessarily true of the other. Doubt is excluded here, because by the terms of the proposition no variation is possible: there is no inference. But now contrast this with a case of Reasoning, which to many minds would have equal cogency, because not only is it founded on an induction from millions of observations, with no contradictory cases, but because the terms are presented so clearly to the mind, that the conclusion would be irresistible could we be quite certain of the induction, which we never can be so long as it remains an induction. The case is this: All observations of animals having separate sexes record the fact that these animals reproduced their kind only by the sperm cells of the male fecundating the germ cells of the female; hence the induction that offspring are the products of fecundated germs furnishes the deductive conclusion that any animal belonging to this group of bisexual animals must have been so produced. Here are two acts of Reasoning, inductive and deductive; and till a few years ago every naturalist would have held these conclusions to be irresistible; although no one profoundly versed in Logic would have overlooked the fact that both induction and deduction were inferences, and possibly inexact. The discovery of Parthenogenesis, wherein the female dispenses with the co-operation of the male, and the virgin aphis, or moth, not only produces aphides and moths, but these products of virgins themselves produce others, without the aid of the males; this, which is now recognised as a mode of reproduction, destroys the unconditional generalisation of the induction. We need scarcely add, that

while Euclid's proposition is absolutely true, because it is reducible to an identical proposition, and is not a truth of Reasoning, since there is no Inference; in like manner the naturalist's proposition will be absolutely true, if we exclude Inference by limiting the terms to those of the identical proposition, "All products of fecundated germs are products of fecundation."

63. Here we return once more to the unsatisfactory notion of Reasoning being characterised by the passage from the known to the unknown, and evolving from its premisses a new and distinct conclusion. If it be said that when I infer that an alkaloid will have poisonous properties, the fact being certainly not known to me before trial, and being only concluded by me because of the resemblance of the new substances to substances known as poisonous, I have reached the unknown by Inference; the answer simply is, that the unknown fact is not *reached* at all, but remains unknown until it be known, which is to be effected by a very different process. If it be said that the conclusion is something new and distinct from the premisses, and therefore must be what was unknown before, the answer has already been given in treating of the Syllogism, namely, that the conclusion simply re-states what has been stated, explicitly or implicitly, in the premisses; and if it bring anything in which was not already there, the conclusion is illogical.

64. Having rejected the distinction between Perfect and Imperfect Induction and Deduction, we must also reject that between Perfect and Imperfect Reasoning, unless we are speaking of the products, not the process. In this latter sense we may say that such or

such Reasoning is not valid, or is not sufficiently buttressed by fact; but the process is none the less perfectly performed. Reasoning from Analogy, for example, is the same process as that by which the most valid induction is formed; it differs only in the symbols operated on.

Finally, we may note that *reasonings* pass into *reasons*, from which all contingency is excluded, and which are therefore intuitions,—truths seen by the Intellect as, to speak metaphorically, objects are seen by Sense, very much as intelligent actions pass into instincts when the discursive element of choice is lapsed. (Compare what is said on Instinct, vol. i. p. 226 *et seq.*) A conclusion is an inference until it is established as a truth; once verified, it takes its place among the data of positive knowledge. Observe the parallelism here between the Logic of Feeling and the Logic of Signs. From sensations we pass to inferences, which are representations of what will be, or would be, presentations; and the proof of the correctness of such inferences is the conversion of re-presentation into presentation. Thus Sensation, Inference, and Sensation again, are the three terms in the progression of Knowledge; and in the ideal sphere this progression is Datum, Hypothesis, and Verification: a starting-point, a search, and a finding.

CHAPTER VI.

ON THE EXTENSION OF KNOWLEDGE THROUGH REASONING.

65. The discussion just concluded has not been undertaken for the somewhat trivial purpose of rectifying the ambiguities of logical theories, but for the important purpose of exhibiting the psychological foundations of Speculation. We have there seen, in the nature of Reasoning, how inexorably Knowledge is limited to Experience; and how all supra-sensible conceptions are metempirical and vain. Hence the attempt to penetrate the secrets of Nature by Reasoning alone has always been, and must for ever be, a failure.

And we are now in a position to answer the question, proposed some time since, How is it possible to extend Knowledge by means of a process which is only valid when it is a re-statement of what is already known? Our exposition of Reasoning may seem to lead to Plato's conclusion that all Knowledge is nothing but Reminiscence; Discovery seems taken out of its hands. Yet on reconsideration it will appear that we have only specified the kind of instrument which Reasoning is, and that we have only taken Discovery out of its hands when Reasoning pretends

to be all-sufficient. Discovery is reasoned Experience. It must be verified by the reduction of Inference to Sensation or Intuition, otherwise it remains mere guesswork, not Knowledge.

66. This may seem a truism. Yet the constant practice of metempiricists, and the teaching of most mathematicians, show that the truism is disregarded. The belief that physical or metaphysical discovery can be made *à priori*, and by Reasoning alone,* is sustained by the belief that Mathematics is a science of pure Reasoning, and is independent of Experience. The two beliefs fall together. I have already (vol. i. p. 415) pointed out that Mathematics employs the Method of all Science, and has equally to find its data in Experience, being unable to stir a step without the aid of Observation, Induction, Hypothesis, and Experiment. There is no doubt a certain sense in which we may say, with De Morgan, that "all mathematical theorems are *concealed* truisms, the mere repetition and echo of our definitions of the quantities about which we are busied, and of the laws of the operations we perform on them;"† and in this sense Bailly's description of Mathematics, "cette immense postérité d'un même père," may be allowed. But these phrases must be interpreted. To suppose that new mathematical truths are evolved deductively from axioms or definitions, *irrespective* of the intuition of the new relations given in the new figures or terms, is equivalent to supposing that the human race issued from Adam and the sons of Adam, without the co-operation of

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Eve and the daughters of Eve. Let those who hold that mathematical truths are simple deductions from axioms, unaided by intuition of the relations of the figures, try this in some case unknown to them. Let them, for example, take the definition of a cycloid, and, aided by all the axioms, let them discover the ratio of its area to the generating circle. It will be as futile as attempting from the axiom of causation and the definition of alcohol to deduce what the effect of a dose of alcohol would be on an organism, before experiments had revealed the kind of effect.

67. Condillac has fallen into the error of suppressing the co-operation of Experience in his otherwise suggestive derivation of all Knowledge from a series of identical propositions.* He argues that it is a progression of identities. When we investigate a subject, we pass from one property to another by a succession of equations; each property is disclosed to be *the same* as the other, under different aspects. We cannot seize all these aspects at once, otherwise they would be to us, as they are in themselves, *the same*. Every science would then be reducible to one primary truth, which, in transforming itself, would present all the discoveries that have ever been made, and all that could be made. Laplace has a somewhat similar speculation.†

* Condillac: *Langue des Calculs.*

† "Nous devons envisager l'état présent de l'univers comme l'effet de son état antérieur et comme la cause de celui qui va suivre. Une intelligence qui pour un instant donné connaîtrait toutes les forces dont la nature est animée, et la situation respective des êtres qui la composent, si d'ailleurs elle était assez vaste pour soumettre ces données à l'analyse, embrasserait dans la même formule les mouvements des plus grands corps de l'univers et ceux du plus léger atome: rien ne serait incertain pour elle, et l'avenir comme le passé serait present à ses yeux." —Laplace: *Essai philos. sur les Probabilités*, 1840, p. 3.

68. If, on first learning by experiment, or from the experiments of others, that water was composed of oxygen and hydrogen, and that food would not nourish an organism unless it were liquefiable and decomposable in the organism, Condillac had been asked whether he knew these things before, and whether this knowledge was the *same* as that which he had already gained by contemplating water and food, he would assuredly have answered, No. The newly-discovered properties are indeed the same as the old properties, under new aspects, but it is this novelty of aspect which is the addition to Knowledge. For increase of Knowledge there must be either a new presentation of the object to Sense, so that new properties may arise in new feelings, or a new presentation of *relations* not hitherto intuited. The mere iteration of sensible impressions and ideal intuitions will not suffice. And if by Induction or Deduction, or if by any artifice of combination, we arrange the old materials into new forms, these new forms are no increase of Knowledge, because—1°, if they simply repeat the old experiences, the stock of objects and relations is not enlarged; we have only, as it were, new words for old conceptions; 2°, if they introduce any hitherto unobserved elements, so as to constitute a real addition to the old stock, such introduction is a fiction of the mind, which demands objective verification before it can be reckoned as Knowledge. Were this not so, any fancy would have the place of an experience, any guess would be an addition to Knowledge. Discovery is the marriage of Reason with Observation; but, without the co-operation of Experience, Reason is a "barren virgin." The virgin, as

Physiology teaches us, is prolific in the production of ova; but unless these ova are fecundated, none of this activity increases the population.

69. This illustration suggests an objection, which is in turn illustrative of our position. The reader who remembers what was said, § 62, respecting the reproduction of certain animals from unfecundated ova, will ask whether, in like manner, although the normal process of Discovery requires the union of Reason with Observation, yet may not in a small number of cases Discovery be effected by Reason alone? The answer is, that the production of animals from unfecundated ova is only possible after *ancestral* fecundations; the virgin parent is the product of male and female parents, and she only reproduces virgins (or, in the case of bees, males). So Reason, unassisted by Observation, can only reproduce conclusions formerly produced by the marriage of Reason and Observation. Let us see this in a particular example.

70. Here are two colourless gases, oxygen and nitrogen, which we, having never experimented on, know only as colourless. The chemist asks us, What will be the colour resulting from uniting them? Trusting to Reason alone, we reply, No colour at all, unless it be that of a more or less turbid mixture. How can two colourless gases yield colour simply by uniting together? Reason rebels at the contradiction; and if we were to trust to Reason, and to follow Descartes in reliance on the one sole test that "whatever is clearly and distinctly conceived is true," we should be satisfied with this verdict. The chemist, however, is inexorable in his requirement of Obser-

vation. He bids us unite the gases, and lo! the nitrous acid which results is of a deep orange colour. Here is something really new, an addition to our Knowledge; but not one which could have been gained through Reason. This fecundated germ, however, will hereafter reproduce its like; and whenever we see or think of the two gases, we shall rationally conclude that their union will yield the orange-coloured nitrous acid, unless some condition be present to interfere with this result. Again, we know that the atmosphere contains nitrogen and oxygen, and that both these gases absorb heat radiations in fixed quantities; if, therefore, these gases are combined together, and form nitrous oxide, we must rationally conclude that the absorption of heat radiations by this oxide will be equal to the sum of that of the two gases, or equal to that of the atmosphere. But what says Experiment? According to Professor Tyndall the absorbing power of the oxide is more than 1800 times that of the atmosphere. (On this point see RULE IX.)

71. In the *Psychological Principles* (vol. i. p. 117) a comparison was made between Experience and Nutrition. The bodily organism is nourished and grows by taking up fresh material from the External Medium, which in the Internal Medium undergoes assimilation—*i.e.*, all that in the material taken up is *like* what already exists in the organs, and can be extricated from its *unlike* accompaniments, is transformed into the substance of the organs—the unlike being rejected. A similar process goes on in the Mental Organism. The mass of sentient material has been assimilated out of multitudinous sensory

impressions—those which were like former impressions having been incorporated, and the unlike left ungrouped. Whatever cannot be assimilated by the organism is either excreted, or remains there a *foreign* substance, not becoming vital. Much that passes for Knowledge—"learnt by heart," as the phrase is—comes under this head, and may be said to be *on* the mind, not *in* the mind.

The organism not only grows in bulk but in complexity, and consequent variety of powers. Old tissues increase in size, and develop differences of structure; new tissues slowly arise by the union of some new elements with the old, and then each new tissue is itself the starting-point of a further differentiation. Two masses of protoplasm in all respects alike increase in size, and from some cause or other one of these takes up and fixes in its substance a trace of carbonate of lime. From this point will arise a wondrous divergence: fresh particles of carbonate of lime will be added, and a solid skeleton will result: the fact of having a solid support will be the origin of a vast series of organic differentiations. Thus also with the mental organism. The incidental assimilation of some novel idea, in itself seemingly insignificant, will form a nidus for a whole system of thought. The creation of a new sensibility to differences in objects is effected in this casual way, and when such a susceptibility is ready, it rapidly finds nourishment. But how, some reader may ask, is any differentiation to take place if the organism can only assimilate what is like its own substance? How does the new element find its acceptance? Only by being held in solution in the plasma, and deposited by small increments. The

carbonate of lime must be soluble and contained in the assimilable food. The new idea, or new experience, must be soluble in old ideas, familiar experiences, otherwise it will not be understood, comprehended, felt. A conception entirely, or even largely novel, is not intelligible to the acutest intellect. It must have its points of attachment, its likeness to familiar conceptions, otherwise it cannot be assimilated. But if there be only one point of identification, that will suffice as a nucleus for further growth; and gradually all the diversities which make it foreign to the mind will be incorporated with elements of likeness. The nervous centres, having once been impressed in any way, easily respond to a similar excitation. A sensation having once been separated, as a group of neural tremors detached from the general mass of irradiations which a stimulus excites, becomes, so to speak, the channel for future tremors, and being readily linked with other groups, a new experience of objects arises. The evolution is very slow and complicated, yet we may be quite sure that it is only by the gradual assimilation of what is like, and its separation from what is unlike, that knowledge advances.

72. The differentiations of knowledge are manifold. When one fact is added to another, and the second is seen to have been already implicitly included in the first, the addition is sometimes merely that of a name, sometimes of a quantity. To know that *ἀνηρ*, *homo*, and *Mensch*, respectively mean the same as *man*, is a distinct addition; so is the knowledge that one side of an equation is the same as the other side. Every new presentation of an object discloses a new property or a new relation, new in kind or degree; but by no

manipulation of Reason can a new property or relation be discovered. No meditation on the nature of water, as known to us through common Experience, will disclose its gaseous constituents before this new fact of composition has been presented to Experience. No meditation on the nature of a circle will disclose its properties without sensible intuition of the figure and the relations of its parts. The first of these propositions every one will accept; the second will be generally denied, for we seem capable of evolving new mathematical truths by intense meditation on the truths already evolved. The source of this illusion it is easy to trace. The simplicity of the relations, and the rapidity with which they are mentally juxtaposed and intuited, disguise from us the real process; but we have only to consider some case in which the relations are not so easily intuited to become aware of the experimental control needed for every step. No meditation on the number 10 will disclose to the savage the truth that, multiplied by itself, it will equal 100; none but an expert calculator sees at once that the cube of 7 is 343; none but those who have traced the relations step by step can see that the square of the hypothenuse is equal to the squares of the other two sides of the right-angled triangle—meditation on the triangle, unaided by a construction presenting it under new aspects, will never succeed. These three conclusions are indeed seen to have been implicitly contained in the premisses, otherwise they would not be true; but to render them explicit there is needed a new presentation of the relations,—generally a new presentation to Sense.

73. We do not undervalue the power of Reasoning

in thus specifying its range, we only guard against its illusions. By its process of assimilation it is incessantly leading to valid conclusions where the region of the Sensible is overstepped, and that of the Extra-sensible entered upon. But—and this is the all-important consideration—the Extra-sensible must only be a prolongation of the Sensible, and the deductions must simply reproduce unchanged what the inductions have guaranteed.

74. A physical illustration will perhaps make this intelligible; and for this purpose nothing can be more striking than the discovery of the interference of light, a magnificent example of deductive reach. Observation had familiarised men with the fact that when two equal waves meet on the surface of water, one of two different effects might result: either the crest of the first wave would sink into the hollow of the second, and a flat surface replace the waved surface; or else the crest of the first wave would be added to the crest of the other, and the hollow of the one to the hollow of the other, whence a higher wave replacing the two waves. Here were sensible facts, the symbols of which, so far as they expressed wave-motions, were capable of being deductively applied to any case of wave-motion whatever. When the hypothesis that Light was due to wave-motion had acquired sufficient consistency to be employed with confidence, the identity of relations amid great diversity of objects flashed upon the mind of Thomas Young, and he *saw* that if Light was wave-motion, the meeting of two luminous waves would be identical with the meeting of two water waves, so that the result would be, either darkness or increased

brightness. That two luminous waves should produce darkness was paradoxical, but not more so than that two water waves should destroy each other, or two motions arrest each other. Here was a case of pure prevision, one which might be cited as a convincing example of reaching the unknown through the known. Yet on examination we see that the prevision might have been erroneous, and was not knowledge until experiment had verified it. The deduction assumed the homogeneity of the two motions and their consequences; assumed that, however water and ether might differ, they agreed in so far that their motions obeyed the same geometrical laws; and to this assumption was added a second, namely, that *the effects would be the same in these different media,** and would not be counteracted by gravitation or any other condition. Thus the deduction assumed that Light was a function of wave-movement; and the

* A remarkable example of the uncertainty of deduction, when different media are in question, has quite recently appeared,—the fact discovered by Mr HERMANN SMITH, that the so-called "air reed" (into which the stream of air is moulded in the embouchure of an organ-pipe) has a law of its own quite unique among the phenomena of musical vibrations hitherto observed. All our knowledge of rods and strings, of plates and membranes, would lead us, as he remarks, to expect the usual manifestation of the law of isochronism, that in the air reed, considered as a free rod fixed at one end and vibrating transversely, the law would be observed, that however the amplitude may vary, the times of vibration will be the same; nor would any one hesitate to rely on this deduction as an extension of observed phenomena to a case seemingly in all essential respects similar. Nevertheless the air reed shows an absolute reversal of this law—the times of vibration vary with the amplitude. Mr SMITH has proved this experimentally, and instructively adds: "Familiar as the air reed had been to me, the one secret had been hidden from my eyes; seeing, they saw not. Faith in the known mode of activity of the transversely vibrating rod had blinded me."—*Nature*, 1874, vol. x. p. 161.

experimental proof of the prevision has justly been regarded as a confirmation of the assumption. This confirmation has been further strengthened by the splendid operation (analogous in nature) by which Sir W. R. Hamilton proved mathematically the existence of *conical refraction* which no eye had seen. He deduced from his symbols the conclusion that although a beam of light entering a double refracting prism was in general split in two, yet there were biaxial crystals in which, if it entered, it would be divided into an infinite number of rays forming a cone; also that there were directions inside the crystal in which if a ray were to pass it might emerge as a hollow cone instead of two separate rays.

The reader will observe that in both these cases the deduction required Verification before it passed into Knowledge; it might have been erroneous; and, moreover, in neither case was something unknown reached—I mean, not a new and distinct addition to the premisses, but simply the application of what was clearly known in one group of phenomena to another group assumed to resemble it in that respect. The sole point that was unknown in each case was whether the fact assumed did, or did not, correspond with reality; now *this* point no Deduction could possibly reach. When Kirchhoff and Bunsen had ascertained that all the known metals had their respective lines in the spectrum, they were in a position to deduce the existence of an unknown metal from the presence of a line to which no known metal corresponded. But they did not discover *rubidium* and *cæsium* by this deduction; they only inferred its existence; and, however great the probability, this must have remained a mere

inference, and possibly an error, so long as the metal itself had not been drawn from its obscurity. The mighty instrument which Stokes, Balfour Stewart, and Kirchhoff have placed in the hands of philosophers, and which has already modified profoundly our conception of the sun, affords a good type of deductive research: it is powerful over solar chemistry because that is an extension of terrestrial chemistry, and it is powerful over terrestrial chemistry because it has the wide generalities of solar facts: we learn the constitution of the sun by applying the knowledge of our laboratory, and we extend our knowledge of the laboratory by applying the inductions of solar facts.

75. Plato in the *Meno* has ingeniously expounded the hypothesis that all Knowledge is reminiscence. When truth is presented to us, he says, we recognise it as we recognise an old friend after long absence. We know it because it is a revival of our forgotten experience gained in a former life. "Since then all the parts of Nature are analogous or cognate, and since the mind has, at some period of its existence, gone through and learnt them all, the revival of any one track sets going the revival of all the rest." This is illustrated by questioning a slave who, though he had never heard of Geometry, is brought to solve a geometrical problem by simply answering the appropriate questions.

Apart from the notion of a pre-existence in another world, there is much in this which tallies with what is expounded in PSYCHOLOGICAL PRINCIPLES respecting pre-perception and pre-conception. The omission of a continuous addition of fresh experiences, as

necessary to every enlargement of Knowledge, is, however, a defect in Plato's theory.

Aristotle in the *Posterior Analytics* also takes up the question: "All learning by way of inference proceeds from what has previously been learnt. . . . When, however, implicit knowledge becomes explicit, the universal premiss may be antecedent to the conclusion, while the particular is simultaneous. Thus when the interior angles of every triangle are antecedently known to be equal to two right angles, no sooner is the particular triangle in a semicircle given by observation, than our knowledge of the conclusion is simultaneous with it. Before the minor premiss is observed and the syllogism constructed, the conclusion is in one sense known, in another sense unknown. Before we know the existence of an object we cannot without some qualification be said to know what attributes it possesses: we may be said to know it implicitly, or as an universal; not as a particular.* This is the way we must solve the dilemma in the *Meno*, where it is argued that we can learn nothing, or else only what we know already. . . . It is not inconceivable that we should learn what we already know in a different point of view; but it would be absurd that we should know and not know one and the same thing in one and the same point of view." †

Aristotle here manifests a true appreciation; and indeed throughout his writings, in spite of a too great reliance on Reasoning uncontrolled by Observation,

* *Post. Anal.* I. c. 1. Πᾶσα μάθησις διανοητικὴ ἐκ προϋπαρχούσης γίνεται γνώσεως. . . .

† Ὅτι καθόλου ἐπίσταται, ἁπλῶς δὲ οὐκ ἐπίσταται.

which was inevitable in that stage of culture, he displays an abiding conviction of the importance of the direct interrogation of Nature, and of submission to what Fact discloses.

THE THREE METHODS.

76. The cardinal error of what is known as the Subjective or Speculative Method, contradistinguished from the Objective or Scientific Method, does not consist, as is sometimes said, in the interpretation of objective facts by subjective facts, phenomena by ideas, for *that* is equally the procedure of Science; but consists in the precipitation with which the ideas are generalised from particulars, and in the application of such symbols to *other* things than those really symbolised: in other words, it consists in Deduction without Verification. The metaphysical thinker is said to impose his conceptions on phenomena instead of observing them; and it is found that these conceptions are not only generalisations of partial aspects which are made the symbols of all the aspects, but they are also conceptions which are partly the products of emotion or fancy, assigning to casual analogies the value of causal connections. Instead of interpreting his symbols and testing his inferences, he applies his symbols deductively to things which were not originally gathered into those general expressions, and trusts the validity of inferences he has not tested. The scientific thinker also applies his symbols deductively, but he is (or ought to be) on his guard against unverified Deduction, and treats it as a tentative process. His conceptions are trustworthy, so far as he

has formed them out of verified perceptions, and applies them only to cases which have every appearance of being similar in kind to those already classed together in his inductions; but aware that this similarity is an unproved assumption, he awaits the result of investigation before finally concluding that the application of his symbols is here warranted. The *purely* Deductive Method would be as fatal in Science as it is seen to be in Metaphysics, were it not that the conceptions of Science are commonly more accurately representative of perceptions, and therefore more extensively applicable to reals. The errors of both are not errors of Reasoning, but errors of Application; and the exactness of any science, say of Mathematics, lies wholly in the limitation of its symbols to the significates they express.

77. The Inductive Method is frequently contrasted with the Deductive, and both of these with the Metaphysical Method, which is called in Germany the Speculative, and in one school is based on the power of Intellectual Intuition, in the other, on the power of Dialectic. No one of these Methods is efficient unless it be completed by the method of Reduction, verifying step by step the terms employed; whereas each is efficient under this condition. Induction is good, Deduction is good, Speculation is good, but each and all are anticipations, not investigations (to use Bacon's antithesis); they are finger-posts, not pathways. When an induction is freed from all contingency, it is registered in an identical proposition; when it is more, it is a guess. So with Deduction.

78. There are indeed but two ways of supplementing Experience so as to extend its range beyond what is or has been felt. These are—1°, Inference, which assumes that the unseen will be of the same nature as the seen; and 2°, Naming, which condenses manifold experiences in symbols easily operated on. Both are generalisations of Experience, neither can have any validity not derived from Feeling. A generalisation is a register or a finger-post, according as it gathers into one expression all those observed particulars which are alike, letting drop those which are unlike and individual—or as it points out the probable existence of particulars not actually observed, by extending to the unobserved cases what is already known of cases resembling them, dropping any individual differences. Thus terrestrial and celestial movements are generalised under Gravitation, in spite of their obvious accompanying differences; and from this generalisation we infer its extension to double stars and throughout the universe. Sensibility, observed in ourselves and inferred in all the higher animals, is extended to all animals with a nervous system.

The manifest importance of such registers need not here be dwelt on. The knowledge, for example, of the law that water will find its level—a generalisation of observed facts—enables the modern engineer to dispense with the costly aqueducts which brought the water only to one city, and to construct a network of pipes which distribute the water to various cities distant from the source, and to every street in each city, every house in that street, and every floor of every house. But while recognising the importance of

generalisations, we must also recognise their limits. The lesson we most need in Philosophy is that which is written in centuries of failure—not to rely on Reasoning alone as a means of Discovery.*

* See *Appendix* B.

CHAPTER VII.

RETROSPECT.

79. HERE ends our survey of the nature of Knowledge, its limitations, its certitude, its methods. We have viewed the subject from many sides, always bearing in mind those cardinal facts of Experience on which the advocates of a possible Metempirical Science rely, and always at every turn finding those facts capable of a better explanation on the principle which excludes the Supra-sensible altogether from research, and admits into its calculations only the known functions of unknown quantities. What is given in sensibles and extra-sensibles furnishes the material of Knowledge; whatever transcends these is a Mythology of abstractions, the rise of which forms an important branch of psychological inquiry. The belief that these abstractions are more than symbols, and are representatives of a deeper reality than can be found in phenomena, is the illusion of Metempirics.

In the course of the discussion we have reiterated certain statements so many times, that many a reader may have been made impatient. If his impatience is excusable, my procedure has the excuse of a deliberate purpose. Daily seeing how the clearest thinkers are misunderstood [illegible] presented, less from the

critic's want of penetration than from his want of remembering the principles on which the conclusions rest—and admitting that no reader who has not thoroughly assimilated a writer's principles can be expected to remember in the middle of a treatise what was laid down in its early pages—I preferred sinning against the laws of good writing by frequent repetition, to frustrating the very object of my writing.

80. Knowledge we have seen to be virtual Feeling. Its origin, its material, its aim, is always Feeling. What is called Thought is Feeling under symbolical forms; and its symbols have to be interpreted in terms of Sense before they can be accepted as the *rational equivalents* of Things; sensations being the *sensitive equivalents* of qualities. All cognitions—even the most abstract—are primarily feelings.

81. The Known is that which has been felt and distinguished. The Unknown is that which has not been felt, or not been distinguished. The Unknowable is that which cannot be felt or distinguished. The limits of the Unknown are fluctuating, those of the Unknowable are fixed and absolute, so long, at least, as the present constitution of man and the Cosmos remains. A simple change of position would bring what is now unknown within the circle of knowledge, as the guano now lying on the coasts of Peru may be brought within the assimilative range of the cereals of Surrey. But to bring what is unknowable within our circle would require a change in its nature, or in ours.

82. Things and relations not directly accessible to Sense are indirectly accessible. Sense is supplemented by various impulses and artifices, which we have described. These justify themselves by their success in

rendering indirect knowledge equivalent to direct knowledge; and thus making the internal order of thought so far represent the external order of things, that the one may be relied on in lieu of the other, and our actions be regulated by our prevision of their consequences.

But there are also impulses and artifices which seek to evade the primary conditions of knowledge, and seek elsewhere than in sensible Experience for revelations of what things are and will be. These we have described, and shown how they are doomed to failure on two grounds: First, because we have no organ for the apprehension of the Supra-sensible, but are restricted within the sphere of Experience; secondly, because such an organ would be valueless as a guide through the sensible world, with which alone we have to deal.

83. I have done my best to make this clear; but of course could have little hope of convincing those who deny the very principles on which I proceed. Even among my friendly critics there has been some dissatisfaction felt respecting my method of disengaging the empirical elements from the transcendent, and treating both on the same footing as they are treated in Mathematics or Physics. On the one hand, it has been objected that I ought to have left such metaphysical topics as Matter, Cause, Force, Life, &c., to the several sciences which respectively furnish the data of such abstractions; on the other, it has been objected that by eliminating the metempirical elements I give up all hope of reaching that innermost core of truth which every metaphysician seeks, and therefore my Method is an evasion of the question at issue.

84. Let me take the second objection first. I have pondered on it long, and under many aspects, and always come to the conclusion that the Method is not an evasion, but a more precise statement of the question. Although it restricts metaphysical research within sensible and extra-sensible limits, and in so far necessarily fails to gratify the desire for any knowledge of what lies beyond, the restriction renders solutions possible which its removal renders impossible; and these solutions having the character of positive science, Metaphysics has a place among the sciences, which are all under a similar restriction; and finally, the necessity of this restriction is proved by the arguments which show that if Metaphysics is separated from Science in virtue of its possessing a different Method in the quest of a totally different Object, then the metaphysician is called upon to prove that a special organ exists by which supra-sensible relations can be apprehended, and that a special Logic exists having its own canons and procedures, not amenable to the Logic of Science. In other words, there being no place for the Supra-sensible in our system of Experimental Knowledge, a new and altogether different Transcendental Calculus must be applied, and this *not* to the objects of sensible Experience, but to

> ——— "the measures and the forms
> Which an abstract intelligence supplies
> Whose kingdom is where Time and Space are not."

I think it is no evasion of the question, which justifies the exclusion of the Supra-sensible, and drives those who refuse to accept the exclusion to the definite alternative of invoking a peculiar source of knowledge, either in the shape of Innate Ideas,

Fundamental Forms of Thought, Intellectual Intuition, or Faith. I have driven them to this alternative all the more decisively because I have carried away the pillars of their temple in proving that Mathematics is empirical throughout, and that Necessity and Universality are not criteria of a knowledge transcending Experience, but, on the contrary, that it is precisely where the range of Experience ceases that the necessity and universality of a proposition vanishes into indistinctness and uncertainty.*

* In the vigorous attack on my first volume by a defender of Metempirics (see *Westminster Review*, July 1874, Art. V.), this need for a special organ, not included within the range of sensible Experience, is doffed aside, and the Intellectual Intuition is said to be something set up by me in order to be knocked down again. All I insisted on was the speciality of the requisite organ, its absolute independence of empirical canons. The reviewer first propounds an arbitrary restriction of Science to only one part of Knowledge, refusing to recognise Science as the systematisation of Knowledge, and asserting that we know much that it has nothing whatever to do with; he then propounds the reason why the methods of Science can never properly be applied to Metaphysics—namely, because "Science deals with phenomena, and its method is the comparison of phenomena *inter se*; Metaphysics, on the contrary, deals with the *relations of phenomena as a whole to other genera of existence.*" I accept this restatement of the Metempirical position, and remark, that if the "other genera of existence" lie beyond the sensible range, they require a supra-sensible organ for their apprehension; and I call upon those who believe in such an organ to produce their evidence for its existence. The reviewer's assertion that Subjective Psychology is a branch of Experience "entirely independent of Science," is only tenable on his arbitrary definition of Science, and cannot be employed against my position; yet it is by means of this definition that he is able to propose as a substitute for the Method of Science what he calls the "universal logic, the organisation formula of the whole of human experience." Now, as far as I can affix a precise meaning to this phrase, it is simply that which is meant by Science—the systematisation and organisation of experience,—which differs from Common Knowledge not in its elements, but in its co-ordination of experiences into a system. Of two things one: either the whole of human experience is limited by the Sensible and Extra-sensible, and no systematisation can extend these limits so as to embrace the Supra-sensible; or

85. And now we may recur to the first of the two objections. The reason why it is not desirable to leave such abstractions as Matter, Force, and Life to be dealt with in the particular sciences which furnish their concretes, is that the workers in these sciences usually deal with such abstractions without pausing to consider their psychological genesis; consequently, for the most part, they accept the ideas traditionally handed down, or silently modify these in the course of their reflections, without informing their readers of the changes thus impressed on the traditional conceptions. That two men of science may wholly agree as to the concrete facts symbolised in these abstractions, does not prevent their differing widely respecting the abstractions themselves. The laws of Force and the processes of Life will be understood alike by each, although one man's conception of Force and Life may be conceptions of transcendental entities ruling and shaping Matter, while the other man's conceptions are wholly different. Now, since we find in common discourse the constant recurrence of Matter, Force, Cause, Mind, Life, &c., it is obvious that these symbols condense and represent certain experiences, into which they may be re-interpreted; and the purpose of the metaphysician is to analyse them, to show what

there is in human experience a certain group of *other genera*, the species of which are neither sensible nor extra-sensible, but are apprehended by an organ which is of a totally distinct nature from that which apprehends sensibles—an organ not to be classed under Feeling, or any of its derivatives; and, consequently, whatever it may tell us is not amenable to the tests of Feeling. Jacobi and Schelling declared there was such an organ; but the proof of its existence is yet to come. On the Intellectual Intuition, compare J. H. FICHTE, *Anthropologie*, 1856, p. 13. He will not be accused of having set up this pretended organ for the sake of knocking it down again.

are the experiences condensed and represented, by what logical processes the condensation takes place, and what real validity is to be assigned to the symbols. This is only to be effected by the aid of Psychology—an aid contemptuously rejected by ontologists, who probably divine that analysis so conducted would be fatal to their pretensions. When the psychologist has shown that all the elements of experience condensed in these symbols are reducible to terms of Feeling, and that all the elements not so reducible are destitute of real significance, his task is accomplished: he has assigned the real and the fictitious values to the symbols; and he can then operate on those symbols in perfect security, never allowing the fictitious values to enter into his final equations.

86. Examination of knowledge shows that it begins with observation of the facts and the sequences of sensations. These are classified according to their resemblances; these classified groups are again distinguished and classified under more general heads. Remote resemblances are thus brought together, and the fundamental identities become apparent. Throughout all the varieties of form there has been one persistent unity of feeling, which persists even through the most abstract forms of Thought; and the Logic of Signs is the Logic of Feeling operating on symbols instead of on images and sensations. The task of the psychologist is to reduce every mental process to a neural process, every conception to perceptions grouped and abstracted, as perceptions are sensations grouped and abstracted. When he has completed his analysis, he finds that there is nothing to be got out of the logical grouping of elements which was not

originally given in the elements; and although when perceptions are re-arranged into conceptions, and conceptions into formulas, these formulas take the place of the multiple experiences which they symbolise, they nowhere open the door to the admission of the Supra-sensible.

87. The positive method followed by Science classifies observations and establishes inductive probabilities; generalises what is known, and concludes that whatever in the unknown resembles it will also come under its provisions. One thing we are especially warned against, and that is the making our generalisations depend upon our conclusions, instead of making our conclusions depend upon our generalisations — assuming that certain facts must be thus or thus, because they lead to certain conclusions. It is this which so often misleads the theologian and metaphysician, who are ready to deduce the truth of a fact from a preconception of what it must be—ready to interpret origins as determined by results—ready to turn the world upside down, and to see a deeper reality in thought than in the sensations from which thought is evolved.

88. The examination of the conditions of knowledge was one half of the task before us; the second half must be an examination of what is known. The *summa genera* of what is known are Matter, Force, Cause, Life, and Mind. The three first will be treated here, the two last must be reserved for future volumes, and in lieu of them we will consider the great metaphysical question of the Absolute. Other problems of profound interest, such as Materialism, Idealism, and the Religion of Science, must also be reserved; the

two first because they are so dependent on the t
of Perception that they cannot adequately be t
before that theory is expounded; and the last b
it must be the superstructure raised upon the fo
tions of the knowable.

PROBLEM IV.

MATTER AND FORCE.

"There is no chapter in the history of man more marvellous than that which deals with his conception of matter. There has been the greatest difficulty in all ages in comprehending its existence, and still more so in conceiving how it can be constituted of so many different substances. . . . . All the theories have been abstract; they have been efforts of the mind to comprehend matter, with a very meagre, if any, classification of phenomena."

ANGUS SMITH: *Life of Dalton*, pp. 74, 117.

"The Metaphysick, though it be in the second and abstract Notions, and therefore be counted supernatural, yet doth it indeed build upon the depth of Nature."

SIR PHILIP SIDNEY: *The Defense of Poesie.*

MATTER AND FORCE.

CHAPTER I.

THE PROBLEM STATED.

1. The problem of Matter is one of surpassing interest; but during the long minority of Science, under the regency of Metaphysics, there was no systematic discrimination of its empirical from its metempirical aspects; consequently general conceptions were so vacillating and contradictory, that discussion only served to darken what it proposed to elucidate. Scientific Method imposes on us the necessity of discriminating the three aspects, positive, speculative, and metempirical, corresponding to the Sensible, Extra-sensible, and Supra-sensible, in order that we may avoid the intermingling of separate meanings under one and the same symbol.

The exactness of Mathematics may be carried into Metaphysics, if the conditions of exactness be rigorously maintained—that is to say, if the symbols have fixed and definite significations. The angle, the circle, the plus and minus, are always interpreted in one and the same sense. When a word has different

meanings, as *tangent* in Geometry and in Trigonometry, or *square* in Algebra and in Geometry, these differences, being defined, lead to no confusion. And so throughout.

This is very far from the case in Metaphysics, where the symbols express different meanings. What, for example, does the symbol Matter express? If we ask, What is Matter? we may receive the most contradictory answers. One philosopher will say that nothing is better known, though it may not be easy to give a definition of it: It is the collective name for the solids, liquids, vapours, and gases, the ponderable, visible, and resistant objects of Sense. Another will declare that it is not these, but something underlying them; not the objects of Sense, but the object of Intellect, the perdurable cause of our sensations of objects. Here we have two conceptions of knowable Matter, the sensible and extra-sensible, the one positively known, the other speculatively known. Differing in these marked characteristics, the two conceptions agree in fundamental respects; the second being a higher degree of abstraction from the abstraction of the first, generalising the particulars given in Sense, stripping them of their individual accidental traits, but not passing beyond the bounds of extra-sensible Experience. This second conception easily passes into the third, which is that of Noumenon, or Thing-in-itself, detached from all community with Sense; a cause of phenomena, not to be apprehended through Experience: a Supra-sensible knowable only through sources which transcend Sense. It is said to be directly intuited by Reason.

There are thus three widely-different significations

attached to the same symbol; and when philosophers are discussing the nature of Matter, they not only for the most part refrain from sharply defining which of the three significations they have in view, but often mingle one with the other in the course of the same sentence. When we are told, as lately we have frequently been told, that "nothing whatever is known of Matter," the meaning of course is, that nothing is known of Matter the Noumenon—a truism, since by its definition *that* Matter is excluded from all sensible and extra-sensible relations. Those who speak thus are often those who profess to explain all phenomena of Matter! Nor are Metaphysicians unanimous even respecting the existence of a knowable Matter. One school proclaims it to be a figment of the Mind, the objective phenomenon of the subjective noumenon. Another school proclaims it to be the shadow or appearance of an existent but unknowable *substratum*. Both separate the thing known from the thing as it is outside the relations of knowledge.

2. We may lessen the confusion by adopting special terms for each of these conceptions, and designating them respectively — 1°, Matter; 2°, Extra-sensible Matter; and 3°, Supra-sensible Matter: symbols expressing the abstraction of sensible phenomena, the abstraction of extra-sensible phenomena, and the abstraction of supra-sensible fictions.

3. Matter, under each of these points of view, is an abstraction, which can only be known in and through its concretes. It is the *subject* of which qualities are the *predicates*. Those who suppose that the logical distinction between subject and predicates is the distinction of two existences, and that there is both sub-

ject *and* its predicates, may rationally conclude that there is Matter *and* its qualities. Hegel says, "When we abstract a thing from all its qualities (*Bestimmungen*), all Form, there remains the unqualified Matter; so that Matter is simply an abstraction. We cannot see, feel, Matter—what is seen and felt is a *specified* Matter, *i.e.*, a unity of Matter and Form."* Again, "Form and Matter are mutually determined (qualified), the one as the other, not posited through each other, not the ground of each other. Matter is rather the identity of the ground and what is grounded. Matter, as the indifferent, is the Passive, as opposed to the Form, which is the Active." If, therefore, we are speaking of the abstraction, it is equivocal to say that Matter cannot be known, since every abstraction, as such, is known; and if we are speaking of the concretes expressed by our abstraction, these are known, or knowable, only when they are sensibles or extra-sensibles.

4. But we are also told that Matter cannot be known because it is only expressible in terms of Force, and "what Force is we do not know." I deny the incapacity; and shall in the next problem specify the concrete experiences out of which the abstraction Force is raised. We may admit that Matter can only be expressed in terms of Force (more precisely in terms of Feeling); but instead of on this ground denying that it can be known, we should say that Force being that which renders Matter knowable, we know Matter in knowing Force, and know Force in knowing Matter. How much is known of either is another question.

* HEGEL: *Logik*, ii. 80.

5. Here arises a complication which will beset the whole discussion unless we form distinct ideas of the separation of Matter and Force as a purely analytical artifice. The two abstractions are but two aspects of the same thing; a separation rendered inevitable by the polarity of Experience, which everywhere presents Existence under passive and active aspects. Force is not something superadded to Matter, it is Reals viewed in their dynamic aspect; Matter is not something different from Force, but Reals viewed in their statical or passive aspect:* either is unthinkable without the other. Force is immanent in Matter, and Matter is immanent in Force. The schoolmen called Matter *potentia passiva*, and Force *virtus activa*. Logically distinguished, they require to be considered apart; and throughout the present problem we shall strive to keep up this separation; it cannot be thoroughly accomplished, but we shall endeavour to eliminate Force, as the geometer eliminates everything but Extension.

6. Connected with this question of Force is the question of Idealism. All the concretes forming the abstraction Matter are the qualities which under their subjective aspect are feelings. The reactions of Consciousness are responses to the *actions* of Matter—*i.e.*, to its forces. We group all these qualities together, and call the objective synthesis Matter, as we group all the feelings together and call the subjective synthesis Consciousness. In like manner we group the

* SCHELLING, quoting the common phrase "Matter *has* forces," remarks how Matter is here presupposed to be something which exists for itself, and quite independently of its forces. *Ideen zu einer Philos. der Natur*, 1803, p. 18.

qualities *as activities* together, and call the objective synthesis Force. By an analytical artifice we detach the objective from the subjective aspect, the qualities from the feelings, and thus form two abstractions, Matter and Consciousness, erroneously supposed to stand on two independent bases as two Reals. We next detach Matter from Force, the passive from the active aspect, and treat them as if they stood on independent bases. The idealist, aware of this artifice, and seeing that Matter cannot really be separated from Consciousness, denies the old Dualism, and says that there is nothing beyond Consciousness and its changes. The materialist replies that there is nothing beyond Matter and its changes. The question therefore assumes this shape: Before Consciousness was evolved (if it ever *was* evolved, and did not eternally exist), can we suppose Matter and Force to have existed? Could they exist in an insentient universe? Could there be such an insentient universe?

Nor can this be, I will not say finally solved, but even plausibly answered, until we have come to an agreement on the theory of Perception. I have, however, already indicated the answer I should make, and in anticipation of future discussion I would ask, *Does the rose preserve its redness in the dark?* Some readers will answer No; others, Yes; according as they hold redness to be the reaction of retinal sensibility to its stimulus, or as they hold redness to be something belonging to the rose in itself. Psychological analysis suggests a third opinion, namely, that the redness is a quality in the object, a feeling in the subject: it is this quality because it is this feeling, and this feeling because this quality. Under either

aspect, however, it is the *product of two factors*; and although no product can possibly exist apart from both factors, yet we can *conceive* one of the factors existing independently of the other. By way of illustration, consider Light as quality and feeling. It is the product of undulations of the ether, and of retinal sensibility. Both factors are indispensable to the product; but either may potentially exist independently of the other. Undulations can be shown really to exist both *before* they have acquired the quantitative rapidity necessary for the qualitative effect of Light, and *after* this quantity has been surpassed. There is no Light, no luminous effect, before the undulations have reached some four hundred billions in a second, nor after they have passed some eight hundred billions: these are the luminous limits; on either side of these limits the retina refuses to respond by the feeling known as luminous quality. But the undulating factor exists, and by the "greeting of the spirit" can be made to produce another quality. We know that the undulations are present beyond the red and violet ends of the spectrum, for we have made them sensible through their actions on other re-agents, and have measured their rapidities. Thus, although all qualities are products of the sensitive organism, in so far as the organism is a necessary factor, we are not entitled to say that no agent operates but what is perceived and as it is perceived; we are only entitled to say that nothing has sensible quality until it is sensibly incorporated. Our Cosmos is indeed the Cosmos of Feeling; but we postulate an universe of Being; and the warrant for this postulate is the experience of ever-fresh accessions from the Unknown

to the Known. For many centuries men were living in a world of electrical phenomena on the largest scale, without the dimmest suspicion of the existence of Electricity and Magnetism, except such as appeared in the trivial phenomena of rubbed amber and load-stones; yet these agencies were in activity, though unperceived and unsuspected. Is it not eminently probable that many other agencies are in operation, but because they have never been distinguished amid the chaos of sensible impressions, there has been no "greeting of the spirit" to confer on them *qualitative* existence?

7. Returning now to our immediate purpose of placing the problem clearly before us, we see that no sooner do we affix precise meanings to the terms than the common phrase respecting our incapacity to know what Matter is must be either a truism or a falsism: a truism if the term signifies *unqualified* Existence, a *substratum* or Noumenon, which is not, cannot be, sensible; a falsism if it signifies *qualified* Existence, sensible or extra-sensible. By similar ambiguities we may be said to know, or not to know, what water is, what sensation is, &c. When the sceptic urges his objection that "we only know what our senses tell us of Matter;" this may be translated into the truism, "We only know what our senses tell us of the sensible." No one ever supposed that a Supra-sensible could be detected by Sense; and those who imagine it can be detected by Intuition do so in defiance of Psychology, which shows that we can have only the intuitions primarily given in Sense. The man who says he knows what water is, means to assert no more than that he has a definite conception of the qualities

which he, and other men, have perceived and designated by the term "water." The term is to him, and to them, a symbol of that group. It is a synthesis of experiences, some of which can analytically be expressed; others transcend expression, and are mysterious. If he attempt to pass beyond the sensible qualities capable of analytical expression, and seeks to know what water is over and above its liquidity, transparency, specific gravity, temperature, &c., two courses are open to him: first, he may resolve the liquid into its constituent gases, and submit these to sensible experiences, which assure him that they are the constituents *plus* a certain quantity of molecular agitation; secondly, not having the means of further reduction, he may call in the aid of hypothesis, and invent a possible group of conditions which would produce the phenomena *if* present; and this double inference of their presence and their influence he must try to verify by the reduction to Sense or Intuition.

THE SUBSTRATUM.

8. Matter is thus known as *real*, by synthesis of sensibles; as *ideal*, by analysis; and it is *hypothetical*, as postulated by analysis and fiction. What is given in Feeling can only be explained by analysis and a subsequent synthesis of the ideas thus gained. The chemist who explains the composition of water has so far enlarged our knowledge of what the group of sensibles named water was and will be under other sensible relations; he has not altered our knowledge of what the water is under present relations: his analysis cannot affect our synthesis of experience. The common error of supposing that a thing really is something

different from what it appears may perhaps cause some reader to urge the following objection: "You imagined that it was the water which had the qualities you assigned to it; now the chemist proves that water itself does not exist, but only oxygen and hydrogen combined in certain proportions, and these have not the qualities of water, but their own different qualities. Nay more: these very gases are only hypothetical elements; they may some day be shown to be compounds. So that wherever Analysis penetrates, the Matter, supposed to be known, disappears, giving place to an unknown *substratum*."

9. Our answer will be, that what is known cannot be reversed by any extension of our knowledge, or by any substitution of one group of sensibles for another. No fact can be explained away; it can only have its genesis revealed in an exhibition of its antecedents. Analysis unfolds, and renders conspicuous, some of the factors already inconspicuously present in the synthesis of Perception or Conception, and thus enables us to explain an experience by connecting it ideally with other experiences. When analysis succeeds in reducing a complex fact to its component factors, sensible or extra-sensible, there is indeed an enlargement of knowledge. When the factors are hypothetical there is no enlargement, only a more or less serviceable guess. Applying these principles to the hypothetical *substratum* invented as an unknown support of real qualities, we see at once that it is not only an hypothesis, but one which is incapable of verification. It is the personification of a logical artifice. We logically separate the subject from its predicates, and then commit the mistake of supposing this logical separation to be real.

We logically separate the abstract symbol of the group of qualities from the concrete qualities severally considered, and then suppose the group to be a different Real from the particulars grouped. But, it may be said, there is an element in the compound *quality* which is something over and above what is felt—the purely objective substance—that which is called the Possibility of sensations—that which *was before* it acted upon Sense to become sensible object, and *will be* when our Sense is in no relation to it. Perhaps so. This may be accepted as a postulate; but my argument is, that this "something more" is simply the *same* objective factor in *another* relation than that in which it exists as a sensible. The substratum is a postulate of possible relations, and the initial error of metaphysicians on this point has been to confound a postulate with a principle. The law of inverse squares, for example, is a principle, not a postulate, and from it Kepler's laws are seen to flow in necessary sequence; but what facts or laws of sensible quality can be said to flow from the postulate of a *substratum?* The law of attraction enters into and manifests itself in the movements of the heavenly bodies;* the one is only a presentation of the other under different points of view. But the imaginary *substratum* does not enter into and manifest itself in sensible qualities; on the contrary, it holds itself aloof, is distinguished from them *in esse*, and is altogether incapable of coming within the range of sense.†

* In what sense this is to be understood will be explained presently, § 38.

† "Matematicamente se si cerca l'effetto di una palla lanciata contro uno ostacolo, si parte dai dati della forma, del volume, della densità,

10. This has been stated very perspicuously by Descartes, who after noticing the various changes which a morsel of wax undergoes on the application of heat, losing one by one its original qualities, yet always remaining the same morsel of wax, remarks that *this* which remains is only perceptible by the mind, it is not a vision, nor a touch, nor was it ever such, although it seemed to be so, but simply "une inspection de l'esprit."* If, therefore, the substance is an ideal, not a sensible existence, we have to trace its ideal genesis; that has been indicated in the preceding paragraph.

11. We logically separate Substance from its qualities, and this is a perfectly legitimate artifice when it represents the distinction between Subject and Predicates; or, to speak more precisely, the general group of qualities from any one special item of that group. When we say iron is solid or fusible, we mean that solidity or fusibility may be observed among the other properties observed in the group named "iron." The substance "iron" here stands for the unspecified properties; the specified properties solidity and fusibility have already been observed (or inferred) along with the other properties, and constitute essential elements of the group "iron." To carry this separation further, and to suppose that there is a Substance which is *not* these properties, is equivalent to supposing there is a Number which is not the sum of its units.

della velocità, della direzione di essa, e non della sua essenza materiale. E il calcolo astratto è applicabile con infallible precisione a tutte le palle, in cui si incontrino i medesimi estremi di fatto, qualunque sia la sostanza onde constano."—ARDIGÒ: *La Psicologia Come Scienza Positiva*, 1870, p. 71.

* DESCARTES: *Meditations*, ii.

12. The foregoing exhibition of the three conceptions which are expressed under the one symbol Matter, was necessary to a clear statement of the problem. Think of the confusion which would arise in scientific discussions if the debaters were not alive to the totally different meanings attached to the term Induction, which expresses a logical process, an electro-static process, and an electro-magnetic process; logical induction is not electro-static induction, nor anything metaphorically like it; nor is knowable Matter the same as Substratum, nor anything resembling it. There is a resemblance between sensible and extra-sensible Matter, but there are also broad distinctions; and when we are treating of extra-sensible atoms, we are treating not of the Matter positively known, but of the Matter speculatively known, not of the Reality which is perceived, but of that which is conceived.

CHAPTER II.

APPLICATION OF OUR METHOD.

13. We have affixed definite significations to our terms, and may now proceed to indicate how rational solutions of all rational questions respecting Matter may be reached through the Method sketched in the Introduction to this work. I say rational questions, and mean thereby to exclude all that are metempirical, since, according to the views here adopted, Philosophy is the product of reflection systematising the data of Experience, sensible and extra-sensible, positive and speculative, but excluding whatever is supra-sensible. Founded upon Observation, and the classification of observations, there are speculative constructions of two orders: one in which Inference extends Observation, always keeping on its lines; the other in which Inference departs from the lines of Observation, and strikes into different paths. The one expands the mind with germinating seeds of Discovery, the other puffs it up with the wind of Debate.

THE RANGE OF EXPERIENCE.

14. And here a word must be said on the important question of Experience, which is of such vital importance that the reader must pardon my frequent recurrence to it. Misapprehension of what that word denotes and

connotes must prevent any acceptance of the empirical philosophy; and the word has been so vaguely used, generally with such unwarrantable restriction to mere sensation, that the conclusions of the empirical school naturally seem narrow, and even absurd. Experience, however, is the legitimate term for all that Science systematises. It is the product not only of the co-operation of all our faculties, called into exercise through all the sources of stimulation (including therefore the fancies, vagaries, and guesses, no less than the truths); it is also the product of social co-operation, the accumulated experiences of truth and guess-work belonging to our age. To speak of Knowledge as limited to Experience, and to understand by these only what our own individual efforts can reach, would be equivalent to speaking of our mastery over Nature as limited to our individual efforts, unaided by the great results of the efforts of the race. Why is it that man, so helpless as an individual animal, is so potent as a social animal? It is (as we saw, PROB. III. § 11) because, instead of being limited to what he can do with his hands and intelligence, his powers are magnified by the instruments and intelligence of millions of men. The experiences condensed in instruments and thoughts lie ready to his hand; with these he operates, not restricted to his individual powers. The long travail of centuries on centuries is entered upon as his birthright; the passionate patience and the painful struggles of millions of workers slowly clear pathways through the jungle; and he walks at ease where his ancestors had to cut their way step by step. If we compare the mighty instruments of the civilised man with the rude instru-

ments of the savage, and note how the commonplace efforts of the one are miracles to the other, we may equally compare the prodigious reach of Knowledge in the one, with the meagre Knowledge of the other, as due wholly to the great principle of social co-operation. But, great as the difference is, we know that it is a difference resulting from infinitesimal increments of sensible experience organised into Machinery both practical and intellectual. Our theories and symbols condense sensible experiences, as our machines condense practical efforts. Our thoughts are but classified observations; our theorems classified thoughts. The observation may be imperfect or illusory, the thoughts may be ill-classified, as the machines may be imperfect. Our progress consists in rectifying both. Each theorem and each machine is the root of a higher power; and we come at last from the flint axe of the early races to the steam-hammer and electric telegraph of to-day; from the blank stare at the stars, which was all the savage had to help him, to the magnetic mirror with which we see and measure the thrills of the earth, or the spectroscope with which we detect the composition of the stars. In like manner the rude guess or fiction of the early thinker is replaced by the symbolical methods of the Calculus and the astonishing previsions of exact Science. Between the computations of even a Pythagoras and those of a Newton, a Lagrange, a Gauss, or a Hamilton, the distance is enormous; yet these are but successive reaches of the symbolical procedure which condenses sensible experiences; and they have only value in that they do thus condense sensible

15. We must therefore dismiss as a vulgar prejudice the notion that Experience is too narrow a basis for the interpretation of Nature; and the correlative notion that any insight can be gained by invoking the aid of the so-called Laws of Thought, or *à priori* truths not raised from the Logic of Feeling into the Logic of Signs, but drawn directly from Consciousness as a supra-sensible source — combinations of ideas which have never been feelings, or never verified by confrontation with reality. It is quite true that we do frame metempirical conceptions, and that many men believe firmly in these conceptions representing the actual order in things, though *not* drawn from the order of feelings excited by the order in things; but it is demonstratively untrue that any insight whatever into the facts of the universe can be reached by means of such conceptions; and, therefore, all metempirical conceptions must be excluded from a Philosophy whose sole purpose is to regulate our conduct by ascertaining the facts of the universe. If, as I often say, the existence of a faculty for apprehending the Supra-sensible be granted, it must be assigned a province to itself, and rigorously excluded from that which is included in Philosophy. It may have the domain of unreasoned Faith to itself; it must not claim a place in the domain of reasoned Faith, which is called Knowledge.

16. The Method which I have expounded, and which I am here to apply to metaphysical questions, does not rest on the restricted meaning of the word Experience so generally adopted by the metempirical school; nor does it rest on the vague recognition of Experience as the guide and test of Speculation; it

rests—1°, on the precise recognition of the psychological limits of Experience; 2°, on the precise statement of the procedure by which Science forms its ideal constructions and verifies its conclusions.

Many writers have declared Experience to be their guide and test, emphatically declaring that to it alone Philosophy must look. But I have already intimated that such declarations have been uninstructive, and must continue so while the limits of Experience are left undefined, and the procedures of Research omit the constant aid of Verification. By Experience these writers, for the most part, meant what the empirical philosophy would designate as a compound of Observation and Fiction—of sensible and supra-sensible inferences; and by Research they meant a procedure of Induction and Deduction without the complement of sensible Verification; so that the results of pure Reasoning were accepted without control. It has been my object to show that even in Physics we cannot hope to gain insight simply by recognising the principle of Experience furnishing the data; we must also recognise the procedures on which the investigation can successfully be pursued; and our best means of coming to a clear understanding on this point is by carefully observing how Science has established the conclusions which manifest their correctness by the exactness of their previsions; and having observed this, we must seek in Psychology for the grounds of such procedure. In other words, the theory of Method must be extricated from the successful practice of investigators, and explained by the laws of mental action. It was Comte's great achievement to have specified all the conditions of the positive

Method; it has been my aim to reduce it to mental laws. In the course of my attempt there arose the conviction that the Method which had gained all the conquests of Physics must be equally applicable to Metaphysics. For this application there was needed the same preliminary distinction between the empirical and metempirical which unconsciously had determined all successful research in Physics. In other words, for all the purposes of Knowledge relating to the Cosmos presented in Feeling, we are limited to Sense and Intuition, or to sensible and extra-sensible experiences, individual and social; whatever lies outside this range may belong to the Universe, but not to our Cosmos, not to the *knowable* Universe, and it is therefore ejected from Research.

THE RANGE OF EMOTION.

17. To complete our survey of the range of Experience which Philosophy systematises, it may be needful to guard against a further misconception, and to state explicitly that the term Feeling, the most general term in Psychology, includes Emotion not less than Sensation and Perception. Consequently the province of Experience not only includes a far wider range than that usually assigned to it (for it includes the extra-sensible), but also those less-definitely expressible feelings which we class under Emotion. When I come to treat in detail of the mental mechanism, I shall endeavour to show the profound and various modifications impressed upon our perceptions and conceptions by the influence of the emotions; and this is to be understood not simply on the side of Action, as determining our volitions, but also on the side of

Speculation, as furnishing objective data for our ideal constructions. The emotions felt in the presence of objects, or their ideal representations, are qualities of the objects, standing on the same level with the other sensible qualities. The terror, the beauty, the joy, the awe, the pleasure, and aversion, are feelings having corresponding reals, equally with the colour, solidity, fragrance, &c. They are the subjective expressions of objective facts, of the relations between objects and Consciousness. They do not spring up uncaused, as products of the subjective factor alone; and the important law, already stated, that we only *see* what interests us, points to the theoretic importance of Emotion in the construction of knowledge, since it shows how phenomena not selected and verified by Interest (which is *virtual* Pleasure or Pain) remain blank and insignificant to the mind, and are not even perceived.

18. It is needless to insist on the great function of Art in the evolution of Humanity, but it is worthy of a passing word, in illustration of the objective reality of Emotion, that even in the very lowest stages of Culture we find evidences of Art. Beauty, if it does not take precedence of Utility, is certainly coeval with it; and when the first animal wants are satisfied, the æsthetic desires seek their gratification. Art not only precedes Science by many centuries, but by far the larger part of all the early explanations of the Universe is greatly made up of data furnished by Emotion; and if we consider the pictures of the Universe which are presented in theological and metaphysical systems, we are struck with the immense preponderance of Emotion in the formation of their mental imagery.

The awe, the terror, the delight in Beauty and Design, the many emotions which external objects incessantly excite, and our natural tendency to interpret the external changes as due to volitions like our own, overpower the impersonal objective interpretation which ranges the perceptions in a series. Thus it is that our first theories are predominantly emotional, and gradually become more and more intellectual as symbols take the place of sensations and emotions; these symbols, being abstract, express only the abstract relations between feelings, not the feelings themselves. Comte's law of the three stages has this psychological foundation: the theological, metaphysical, and positive modes of conceiving phenomena are the modes by which the mind passes from the concrete facts of Feeling to the abstract expression of the relations of such facts, so that the complex feelings which accompany an external event finally receive a simple expression in an equation, the symbols of which are wholly stripped of emotional elements.

19. Science is analytical and abstract. It interprets the Logic of Feeling by the Logic of Signs, raises complex facts into general symbols, and treats these as if they were the facts. Its validity, of course, consists wholly in its correct expression of the facts of Feeling, although the expressions are symbols which have no *resemblance* to the facts. Whenever the symbols or general conceptions denote or connote more than is given in the facts of Feeling—*i.e.*, whenever they denote or connote something different in the facts, or the order of the facts—they lead to false conclusions, and their guidance is misdirected. Now it is one of the peculiarities of Emotion that every wave is widely dif-

fusive; it irradiates its impulse through the organism, thereby calling up trains of other feelings; and therefore an emotion tends to bring forward inferences respecting the External Order which have no corresponding facts present. The terror felt in darkness is in so far a quality of darkness, just as the sensation of sweetness is a quality of sugar. But the emotion of terror is very diffusive, and excites a multitude of inferences; the sensation of sweetness is far less diffusive, and in general only excites the limited experiences of sweet objects, each of which has only a feeble interest. The terror raises images of robbers, wild beasts, ghosts or demons, as probably present; and these, if present, are incomparably more important to us than the presence of any sweet object; and this importance and vividness of feeling carries with it a belief in reality, which dispenses with verification, so that we are more prone to accept the interpretation of an emotion than of a sensation.

20. This is one ground of the unscientific value of Emotion; and there is another in the fact that emotions do not admit of exact *measurement* the one by the other, nor of *mutual corroboration*, as in the case of sensations. The extension, hardness, transparency, velocity, &c., of bodies can be measured; the feelings derived from one sense can be compared with those from another; they can be abstracted from their accompaniments and recombined. Not so with the emotions. If from a certain sensation of light I infer that there is an object present which will affect touch, taste, &c., in the ways previously experienced when such an object was within my reach, this inference can be verified. But I cannot verify the inference from one emotion by that

of another; I cannot, when feeling terror in darkness, measure the amount of the feeling or the darkness by any other emotions; and if I proceed to verify the inferences excited,—the raised images of robbers, wild beasts, or demons,—this cannot take place through other emotions, but through perceptions.

21. Hence, although emotional qualities must be admitted to be real qualities, and Emotion to exert a vast influence in modifying our perceptions and conceptions, and thus helping to determine our mental picture of the Cosmos, we can never admit the data of Emotion into scientific constructions except in those cases where human relations form the subject-matter of scientific investigation. Emotions enter into our general theories of the Universe, but never into our theorems of the External Order in its impersonal aspects.

FIRST NOTIONS.

22. It has been one object of this work to bring forward the fundamental principle which has uniformly animated successful research in Mathematics, Physics, Chemistry, and Biology, and to show that it is capable of guiding Metaphysics to exact results. Indeed, this conclusion is obvious directly we recognise that Metaphysics, if a science at all, can only be the science of the most general conceptions, the coordination of the generalities separately reached in the various departments of Science. I say, "if a science at all," because unless the procedures of Science be admitted, and the method rigorously pursued, Metaphysics must be out of court; whatever it may hope to be, it cannot be Science. On the other

hand, if admitted among the sciences, it must submit to the first condition of research, namely, the separation of the empirical from the metempirical points of view. The empirical point of view we have already defined as that which never regards *unknown quantities* otherwise than in their *known functions*. This means that Science is not concerned with the relations of the transcendental elements of phenomena, the elements which lie outside sensible and extra-sensible Experiences, and are therefore incapable of being expressed in terms of such Experience, and verified by the reduction to Sense or Intuition founded on Sense. Its only objects of research are the relations of perceptions raised into conceptions. Much that is transcendental to-day may become empirical to-morrow; much that we have now no means of bringing within the range of Feeling may be brought within it; more and more of the Unknown may be thus transformed into the Knowable and Known; for the horizon of Experience is a movable and moving boundary. But so long as such transformation is not effected, whatever is metempirical is excluded from research.

23. In the evolution of Science from Common Knowledge, the observations and inductions are condensed into what may be called First Notions (*Vorbegriffe*, the Germans call them), which receive their appropriate symbols in universally intelligible terms, *e.g.*, Light, Sound, Heat, Electricity, Matter, Force, Life, Soul, &c. Such symbols, because they represent experiences, suffice for all ordinary purposes of communication, for which alone symbols are invented. But though intelligible and definite, they are synthetical expressions, which often turn out to be confused,

and even chaotic, when we attempt to reduce them by analysis to their component experiences, and to specify *what* and *how much* the symbols really signify. The uncultured peasant knows the phenomenon Light as certainly as the profoundest physicist; he knows Matter as definitely as the philosopher; but he only knows these in First Notions, which he is unable to analyse with any precision. Suppose him to be of a meditative turn, and we may suppose him to arrive at what a mathematician would call a "first approximation" by decomposing his general Notions into particular experiences. He will then say Light is that by which objects are seen, which shines from a distance to him in sun, moon, stars, or lamps; and Matter is that which he sees, handles, tastes, moves, treads upon, &c.; in a word, it is that of which all his materials are formed. But if he be then asked, "Of what is this Light composed? and of what is Matter composed?" he will perhaps reply, "Light is composed of Light, and Matter of Matter;" or he will confess that he neither knows nor cares. He has no theoretic needs; the First Notions suffice for all his practical needs. He is not curious respecting what lies beyond his vision; a clear gaze at the phenomena is all he wants; and wherever Interest does not stimulate his curiosity, a vague blank stare at the phenomena is all he vouchsafes them.

24. The philosopher does care for more than he can see, and he is a philosopher because he cares. He is stimulated to look with other eyes than those of uninterested minds. He analyses the components of his First Notion; and the data thus furnished are in turn submitted to further analysis. He observes, measures,

and classifies; tries to complete the imperfection of Observation by guesses, and tries to verify each guess. He thus forms a new mental picture, which, however, he knows to be only a further approximation, and which, although clear and seductive, is to be treated as a probability until every inference is submitted to Verification. He relies on his ideal vision as equivalent to real vision when it is practically proved to be capable of being employed as a reality, and when its truth is tested by its consequences. Thus are the First Notions of Common Knowledge raised by analysis into the definite Conceptions of Scientific Theory; but the evolution being slow, the same symbols continue unchanged, the old terms express both the primitive and the enlarged groups of experiences, the extra-sensible picture of the components and their order being superinduced on the sensible picture. Between the First Notion of a circle, and the geometer's Conception of a circle, there is an immense progression; yet both have the same term, both the same basis in sensible experiences; nor could the geometer have gained his enlarged Conception otherwise than through an analysis and enlargement of his First Notion. Again, the old idea of Electricity was that of two fluids, vitreous and resinous, endowed with opposite properties. The fluids have been got rid of, and the observed fact of opposition is expressed in the abstract terms *positive* and *negative*, or cathode and anode. What was true in the idea of a current is retained; but the material current is now only held as a metaphorical expression.*

Although it is true that we begin all research with

* MAXWELL: *Electricity and Magnetism*, i. 38.

First Notions, and conduct the research with the aid of General Conceptions, the process of forming such conceptions is one of ascent from particulars.

25. Hegel endeavours to reverse this process. Seeing that Philosophy is concerned directly with conceptions, and only indirectly with perceptions, he declares that it does not take as the ground of Science that Nature which is given in sensible perception, but discerns the properties of Nature in the absolute Notion (*Begriff*).* I agree with him entirely in this statement so far as it describes the ideal construction of Science; but he seems to me in error in holding that perceptions are not the ground of conceptions, and that we must argue backwards from generals to particulars, from ideas to sensations. This appears the *fons et origo mali* of his system. It is true that any perception, any fact, can only be named by words which are general; and the properties of any object, although felt as individual, are necessarily expressed in abstractions generalised from multiple experiences. But my contention is that knowledge does not take its rise in general conceptions, but general conceptions take their rise from particular perceptions.

26. It is important to bear in mind that all our scientific conceptions are analytical, and at the best only approximations. They are analytical, because Science is "seeing with other eyes," and looks *away* from the synthetic fact of Experience, to see what is not visible there. They are approximations, because they are generalities. Newton somewhere has the profound remark that "we ought not to expect observations to agree exactly with theory, since we know

* Hegel: *Logik*, i. 193.

that observations do not agree exactly with each other." If observations agree with observations, and observations with theory, in general relations, that is all Science can demand, and it is enough. Hence the noticeable fact that our theoretic conceptions often flatly contradict our First Notions, without involving the falsity of either, since they refer to different orders of Experience. For example, our First Notion respecting Light is that Light is visible and its transmission instantaneous. Science teaches that it is invisible, and occupies time in passing from the luminous surface to our eye. The contradiction is superficial. When Science declares Light to be invisible, although the cause of vision (more accurately *one* of the causes), the symbol here stands for the analytical expression of certain undulations of an elastic medium, which are abstracted from the co-operation of the sensitive retina; whereas the symbol of our First Notion expresses the synthesis of undulations and retinal reactions,—of the *felt* and the *feeling*. In like manner, when Light is said to have a measurable velocity (186,000 miles in a second), this is not the expression of our visual experience, but the expression of calculations based on the analysis of astronomical phenomena. Both expressions are true; but they are expressions of different truths, and appear contradictory because one symbol is employed in both cases.

27. The history of Science is the history of the transformation of First Notions into theoretic Conceptions—the systematisation and co-ordination of sensible experiences by the aid of extra-sensible extensions of these. Speculation infers an invisible order supplementary to the visible order, and methods of Verifi-

cation are employed to reduce these extra-sensibles to sensibles. At the basis lie Observation and Induction, condensed into First Notions; at the apex are Conception and Demonstration, condensing observations into laws, inductions into theories, both accepted *quantum valeant*—*i.e.*, they are not to be extended beyond their demonstrated range, in the case of Laws, nor beyond their specified assumptions, in the case of theories. The process of transformation is necessarily a slow one, and therefore the old symbols persist through the changes which First Notions undergo in becoming theoretic Conceptions. Hence perplexing ambiguities and seeming contradictions, the language of Science expressing different orders of experience from the language of Common Knowledge. It is therefore always a great gain to Science when a new symbol can be made to replace an old one which expresses different experiences; but this is often beset with difficulties which render a new symbol obscure.

28. The First Notion which condensed our knowledge of the phenomena of Sound is raised in Acoustics into the theoretic Conception of the phenomena as undulations of an elastic medium, and is then investigated analytically simply as wave-movement. A similar transformation, aided by the hypothesis of an ether, displaces the First Notion of Light and radiant Heat. By these the unexplained phenomena of Common Knowledge are explained as due to the vibrations of the sounding body exciting undulations in the air, and the vibrations of the luminous and heated bodies exciting undulations in the ether. This explanation is proved to be valid—at least approximatively—because the geometric laws of hydrodynamics

are found to be strictly applicable to the observed phenomena, and also applicable to phenomena not previously observed. The prevision thus supplementing vision is held to be true. It is observed that all waves have certain rhythmical or harmonic principles in common; but the different media in which they move determine diversities which prevent our deducing all the phenomena from these general principles. Thus the phenomena of reflection, refraction, and interference are common to all wave-movements, and are therefore applicable to water-waves, sound-waves, heat-waves, and light-waves; but owing to the differences of the media, air and ether, the sound-waves are longitudinal, those of light are transverse to the direction of propagation; and hence some of the phenomena of light (polarisation, for example) are not observed in sound.*

29. But here note two points:—We are not yet justified in extending our symbols to any other phenomena than those which have been observed; nor are we to regard explanations as more than ideal constructions from which many of the real elements given in the synthesis of Feeling are thrown out. Our conceptions, even the most accurate, are but the general symbols of perceptions, and this is why the ideal world can only be accepted as a symbolical representation of the real world. Our perceptions have, indeed, to be raised into intuitions, and these into general conceptions, before the smallest explanation can be attempted; for all explanation is analy-

* Professor JEVONS observes "that it is conceivable that in solids we might produce transverse sound undulations in which many of the phenomena of polarisation might be reproduced."—*Principles of Science*, ii. 296.

tical, and is a mental picture of the invisible, not direct vision. If we could *perceive* the general in the particular, the laws in the facts, we should not need to symbolise, to *think* them; and could we conceive the laws or the facts irrespective of perceptions—could we think them *à priori*—we should not need sensible Experience. But we can do neither; we therefore need both. We need perceptions for the individual facts, and then conceptions to condense these into principles or general facts. No sooner has this condensation and purification taken place, than each new fact which can be classed under a general head assumes its place in the system of Knowledge, and is recognised through this generality. The principle incorporates it, and retains it in Memory by connecting it with similar facts. Without general conceptions, particular experiences would be like the scattered leaves of the Sibyl; unless each leaf be read in connection with the others, its significance is concealed, for in itself it has no significance.*

30. The world considered in Consciousness presents the inseparable unity of a twofold aspect—real and ideal. The world considered outside Consciousness has a parallel unity of the twofold aspect—Things and Relations, Facts and Laws, Qualities and Substance, Pre-

* I was one day in the Hunterian Museum with Professor OWEN, when a gentleman approached, and, opening a small bag, said his workman had found a curious bone which he wished the Professor to see. Before it had left the gentleman's hands a glance had satisfied Owen. "That," said he, "is the third molar of the underjaw of an extinct rhinoceros." To the gentleman the whole significance of this object, read by the light of his general experience, was that it was a bone of some sort. To the anatomist, read by the light of his experience, the bone was not only a tooth, but a special tooth, and of an animal no longer existing.

dicates and Subject. We must therefore be careful to define the aspect we are considering; and when we say Matter is this or that, we must understand whether we are speaking of the Matter represented by our First Notion—which agrees tolerably well with what ordinary men mean by the term—or the Matter represented by our theoretic Conception, which is a symbol varying according to the condition of scientific theory at the time, or according to the individual opinion. The first of these stands for Matter, properly so called; the second, for what I propose to call Extra-sensible Matter, and this it is which is usually meant in philosophical discussion. But this Conception, as before stated, not only gets confused by being mixed up with the First Notion, from which it is not carefully extricated, but also with the Metempirical Conception; so that the discussion, instead of being conducted in definite and constant terms, is rendered confused by the intermingling of indefinite and varying terms, and the positive, speculative, and metempirical data are worked up into a hybrid product. What we have known through sensible experience is mingled with what we have inferred from sensible experience, and what we have inferred from assumptions which are not verifiable.

DEFINITIONS OF MATTER.

31. To take a single example, from the writings, not of a metaphysician, but of an illustrious physicist: "There is one universal Matter," says Boyle, "common to all bodies—an extended, divisible, and impenetrable substance."* This is a definition which most

* BOYLE: *Works* (Ed. SHAW), 1738, i. 197.

writers would accept. Who does not see that it is a purely speculative assertion, if taken for more than the expression of the logical artifice making Matter the subject of certain observed predicates? How do we know that there is *one* Matter in all bodies, and that it is extended, divisible, and impenetrable? All we positively know of Matter is what its qualities are; and if we group these into a general synthesis, naming the group Matter, we are not entitled to infer anything more than is given in the particulars thus grouped.

32. Let us pass on to some other definitions: "Le mot matière a dans le langage philosophique deux acceptions parfaitement distinctes: quelquefois il indique l'être indéterminé en général, par opposition à la forme; plus ordinairement on appelle matière l'ensemble des corps qui composent l'univers visible." * Imagine the confusion which would result in Mathematics or Biology from such a laxity in the terms as this, where Matter means both the indeterminate and the determinate existence, the subject divested of all predicates, and the subject clothed with infinite predicates. If we admit the postulate of an indeterminate existence, by way of logical artifice separating a subject from its predicates, generalising our particular perceptions, and transforming this generality into a substance, we cannot be said to *know* this unknowable indeterminate, since all our knowledge is of determinates. And yet metaphysicians, for the most part, are all actively engaged in trying to solve the problem of Matter by disregarding the known functions, and theorising on the unknown quantity, dis-

* *Dictionnaire des Sciences Philosophiques*, iv. 153.

daining the observable phenomena, and longing for insight into the unobservable noumenon.

33. Not to encumber these pages with the multitude of definitions proposed by metaphysicians, it may suffice to cite that of Schelling: "Matter is nothing but Spirit (*Geist*) viewed in the equilibrium of its activities;" * which may be interpreted thus: "Matter is the Felt viewed in its statical aspect." Thus interpreted, I should accept the definition. All we know is Feeling, and the Changes of Feeling. We class the Felt apart from the Changes, the one as Matter, the other as Force. The *qualities* of Matter are our feelings; the *properties* of Matter are its qualities viewed in reference to the effects of one body on another rather than their effects on us; but the distinction is only roughly used. Both qualities and properties are forces when considered as effecting changes.

In defining Matter as the Felt, we are by no means adopting Idealism. We are simply saying that to us the Existence which is given in Feeling, and abstracted in Thought, is, when considered in its objective aspect, Matter-Force. Whatever the external cause of Feeling may be *out* of all relation to Feeling—however it may exist in relation to other beings, sentient and insentient—*that* is not the Matter-Force with which we are concerned.

In defining Force as the Activity of the Felt—*i.e.*, "mass animated by Velocity"—we mark the distinction between Action and Agent, which, although purely a logical distinction, is of great importance. The question of Force, and the various definitions it has received both from metaphysicians and mathema-

* SCHELLING: *Transcendentalen Idealismus*, p. 190.

ticians, will occupy us in the next Problem. Here we have only to say, that by Force we understand Activity; and what Activity is to Agent, that is Force to Matter. Fully two-thirds of the errors which abound in the lax writers of the day on the subject of Force arise from the notion that it is a special *thing*, an *agent*, a peculiar kind of substance, spiritual or semi-spiritual.*

34. Having glanced thus at the definitions offered by metaphysicians, and proposed the one which will be followed in these pages, it may not be uninstructive to see in how far that definition agrees with the one accepted by mathematical authorities. "La matière," says Poisson, "est tout ce qui peut affecter nos sens d'une manière quelconque,"†—the Sensible, in fact. Biot, after noticing various metaphysical definitions, and the doubts raised respecting the existence of Matter, sets them aside, observing that they do not concern the physicist, who, because he rests wholly on Experience, "appelle corps matériéls tout ce qui produit ou peut produire sur nos organes un certain ensemble de sensations determinées; et la faculté d'éxciter en nous ces diverses sensations, constitue pour lui, autant de *propriétés* par lesquels il reconnaît la présence des corps."‡ In the great work of Thomson and Tait, we read, "We cannot, of course, give a

* It is not only in the lax literature of the day, but even in the writings of celebrated men, that we find Force habitually spoken of as an Agent. M. HIRN, one of the distinguished advocates of the Thermodynamic theory, expressly separates Force from Matter as a "substance de nature entièrement différente, capable de se manifester comme agent de relations, comme lumière, chaleur, electricité,"—in a word, the same as what J. R. MAYER, in a passage formerly quoted, represents as the Imponderable Substance.

† POISSON: *Traité de Mécanique*, i. 1.

‡ BIOT: *Physique Expérimentale*, 1824, i. 1.

definition of Matter which will satisfy the metaphysician, but the naturalist may be content to know matter as *that which can be perceived by the senses*, or as *that which can be acted upon by, or can exert, force*. The latter, and indeed the former also, of these definitions, involves the idea of Force." *

35. In its widest sense, Matter is the symbol of all the known Properties, statical and dynamical, passive and active—*i.e.*, subjectively as Feeling and Change of Feeling, or objectively as Agent and Action. And unless this bipolar aspect be admitted, we shall fall into one of two serious errors—1°, that of supposing two distinct and unallied entities, Matter *and* Force; 2°, that of supposing that we can get rid of Matter altogether, either by reducing it to a projection of Consciousness, or by reducing it to unextended monads, centres of Force attracting and repelling each other.† Both these errors arise from a disregard of the primary facts of Feeling, and from forgetfulness of the principle that, since all explanation is an endeavour to make conspicuous, by analysis into its components, of what was given in the synthesis of Feeling, though inconspicuous there (in other words, explanation is the ideal representation of the constituents of real presentation), there can be no true explanation if the original facts of Feeling are left out of sight. Now it is

* THOMSON and TAIT: *Natural Philosophy*, i. 161.

† "It is probable," says Professor CLERK MAXWELL, referring to this hypothesis of BOSCOVICH, "that many qualities of bodies might be explained on this supposition, but no arrangement of centres of force, however complicated, could account for the fact that a body requires a certain force to produce in it a certain change of motion, which fact we explain by saying that the body has a certain measurable mass. No part of this mass can be due to the existence of the supposed centres of force."—*Theory of Heat*, 1871, p. 86.

indisputable that what we represent by Agent and Action, or by Matter and Force, or less technically by Thing moved and Motion, are inseparably given in Feeling, and must therefore be inseparably united in the Felt.

ELIMINATION OF THE TRANSCENDENTAL.

36. Having thus defined the meaning of our symbol, we proceed to separate the positive and speculative from the metempirical elements, and to attempt a solution of the Problem of Matter by eliminating the metempirical, and systematising what is known and knowable. This is the procedure of the geometer. He takes Space as it is given in the First Notion of Common Knowledge, and raises it into the theoretic Conception of homogeneous continuous Magnitude of three dimensions. He does not inquire, What is Space apart from this? nor, How did it arise in Consciousness? He inquires simply into its geometric properties; these he has to discover, and these he must reconcile with observed fact. Incessantly discovering new relations, he enlarges his theoretic knowledge of Space, but does not trouble himself with the unknown quantity, since the known functions suffice for all his purposes. The presence of the unknown x does not disturb the accuracy of his operations on the known functions, and therefore he regards these and his science as exact. No one would dispute the exactness because Geometry is incompetent to answer the ungeometrical question, What is Space *in itself?* No one would dispute the exactness of Dynamics because the nature of Force (in itself) may be a mystery.* Yet many philosophers do not seem aware

* "Les forces sont de ces choses qui ne peuvent être définies : dire que ce sont des causes de mouvement n'est pas réellement les définir, puisque

of the fallacy which declares metaphysical questions to be insoluble on the ground that we cannot say what Matter, or Force, or Existence, is in itself. These questions are insoluble because they are metempirical; but within the empirical region they are not more insoluble than questions of Mathematics or Physics. Matter is defined by the conditions of its manifestation; that is all we know or can know of it; and that knowledge may be great. There is a Geometry which deals with *perceivable* Extension and its relations; there is also a Geometry which deals with *conceivable* Extension and its relations: that is to say, practical and theoretical Geometry. There is also a Geometry, inappropriately named Imaginary (in spite of its transcending the imagination) which has occupied the speculative ingenuity of some distinguished mathematicians, and which professes to construct a conception of Space at variance with our perceptions (see *Appendix* A). These three Geometries have their parallels in Physics, Metaphysics, and Metempirics; and the constructions of philosophers respecting Matter and Extra-sensible Matter are no more rendered doubtful by the questions and chimæras of Metempirics, than the constructions of Euclid are rendered doubtful by the ingenious speculations of Lobatschewsky and the geometers of a space of four dimensions. For let us grant that the hypothesis of a space of constant curvature may justify itself by the aid it furnishes to Dynamics (and Professor Clifford thinks that it will be such an aid); nay, let us go further, and suppose

ces causes n'étant pas connues d'avance ce ne serait que substituer un mot à un autre. Mais ce qui est essentiel, c'est que leur *égalité* et leur *addition* soient définies avec precision."—DUHAMEL: *Des Méthodes dans les Sciences de Raisonnement*, 1870, iv. 452.

future discoveries to succeed in establishing the existence of such space-relations, revealed in astronomical phenomena, it would assuredly revolutionize abstract Geometry, but it would leave Euclid undisturbed, in reference to the space-relations with which we habitually deal; above all, it would leave wholly unaffected the principle so often insisted on in these pages. And why? Because the revolution could only be effected by an obliteration of the barrier which now separates the known and knowable from the unknowable; it *could only be effected by new sensible experiences and new intuitions*, which would bring what is now transcendent and metempirical within the empirical range, and allow new conceptions to be raised from new perceptions.

37. And so of Matter. If at any future time it manifest itself through new sensible properties, there will be an enlargement of the empirical conception. Meanwhile the space of constant curvature and Matter of unknown properties being excluded from our system, we maintain the exactitude of our present Geometry, and of our present Physics and Metaphysics, in all those propositions which have been verified by the test of Equivalence.

The Problem of Matter therefore is twofold: first, the enumeration of all the properties by which it is manifested; and secondly, the *explanation* of these properties in their extra-sensible relations. In the one we classify the sensible phenomena; in the other we classify the extra-sensibles supposed to be the generators of the phenomena.

CHAPTER III.

THE PROPERTIES OF MATTER.

38. One general remark is needful by way of introduction here. All knowledge is knowledge of relations between feelings. To know that the black form imaged on my retina is an external solid, which, if touched, will not only be felt as solid, warm, and hairy, but may probably turn and bite me, is to connect one group of experiences with former groups, and thus to intuite a relation between the two. The whole of the groups are condensed in the judgment, "This is a dog." My knowledge of the dog is co-extensive with the relations thus intuited. In like manner, to know that the dog is a vertebrate mammal—that water is cold and yielding—that iron melts in a furnace, &c., is the grouping of experienced relations between the objects and my feeling, and between one object and another. This double relativity of object and subject, and of object and object, is specified in *qualities* and *properties*, both being the objective aspects of our feelings.

While there is general unanimity among philosophers respecting the limitation of our knowledge of matter to a knowledge of its properties, there is no little divergence respecting the nature of a property. One widespread error is that of taking it for something *inherent* in an object *per se*, not a *relation* of objects

inter se, or mode of existence determined by the related terms. Thus tartaric acid is supposed to be a substance which has, among other properties, that of decomposing carbonates in water and some other liquids. But that this property is merely the relation between the objects, and does not inhere in tartaric acid, is evident when we substitute alcohol for water, because this substitution of another related *term* brings out another *relation*, and the property of decomposing carbonates is no longer manifested, no longer exists in this case. Hence it is erroneous to suppose that non-manifested properties *exist* although masked by the presence of others; they *are* not, and therefore they do not appear; their place is taken by other properties. In our abstraction of the objects from present relations, and our conception of them in other relations, we see what properties they have manifested, and will again manifest, when replaced in those relations; and this abstraction we name Substance, and these conceived relations we assign as inherent in the Substance. But the artifice is logical, and only represents the facts in their ideal aspect. This is forgotten by those who forget the essential relativity of knowledge. Even those who admit that all our knowledge of movements is of relative movements—the comparison of one body with another in space — often imagine that properties are known in things themselves. Gravity, for example, is supposed to exist as Attraction inherent in every particle of matter. Thus A attracts B, and B attracts A, by virtue of this inherent agent.* A is a centre from which this power

* Note here the confusion of action with agent: gravity is a force, and, as such, not an agent, but an action.

issues, and clutches B, which likewise clutches A; and thus "action at a distance" is imagined. But all that the facts really disclose is a relation between the two bodies, a relation which is mathematically expressed in the law of inverse squares; and the physical data, as we shall hereafter see, are more rationally interpreted by differences of Pressure, the necessary consequences of the molecular motions; but however interpreted, the relation necessarily involves two related terms, and cannot be conceived as existing *per se*, or in one term only. Extension, again, or Solidity, obviously involves the relation of an extended or solid substance with a percipient. All qualities involve feelings; all properties involve reactions. Things are groups of relations, syntheses of properties; they do not exist *per se*, except in our ideal abstraction. They *are* their properties, and they are nothing else. When we say a body may be electric, magnetic, luminous, and hot, all in the same place and at the same time, it is not now supposed that there is a rendezvous for two electric fluids, two magnetic fluids, one luminous matter, and one calorific matter: our fathers supposed this, but we have learned that electricity, magnetism, light, and heat are the different *modes* of vibration which the vibrating molecules take on in relation to different senses and to different bodies. We abstract this molecular Vibration, and make it a sort of entity, as we abstract the material element in all perceptions, and make it Matter. But the Real is each special mode, each particular relation. A Thing is a complex of all its known relations or properties. Hence the vanity of the metempirical search after the Thing in itself, and the secu-

rity of the empirical research which is directed to the knowable relations.

39. This is not the place for an exposition of what is known of the various properties. An Encyclopædia would not suffice. I have said that every quality we *feel* in an object is *really* in that object; so that the general symbol Matter is a condensation of all sensible experiences. But amid this mass of various feelings, various qualities, there are some which are general and some universal. These are commonly fixed upon as the "defining qualities;" but, in truth, all qualities are defining qualities, since it is only through these that Matter is known; if some are fixed upon in preference, it is merely for convenience.

The qualities in objects, which are feelings in Consciousness, are necessarily confined within distinct provinces of Feeling, each of which is ultimate. I mean that each Sense has its distinct and peculiar range, and the several ranges constitute the ultimate and irreducible aspects of Existence. Relations of similarity and equivalence may be detected between these, thus enabling us to construct a scientific unity of Sensation; but each specific sensation remains irreducible to another. That of Light can never be resolvable into that of Heat nor into that of Sound, although all three may be objectively reducible to Undulations. Fragrance will never become Extension, nor Resistance become Taste. It is the same with the Systemic Senses. Here, then, are the primary or ultimate sources of Feeling, which are variously combined in the Logic of Feeling, and afterwards in the Logic of Signs, with the perceptions, intuitions, and conceptions of Com-

mon Knowledge, and thence into the systematic arrangements of Science and Philosophy. Radically independent, these several provinces are also connected by links of mutual dependence, the whole Organism being a connexus of activities; and these links are sometimes so close that one sense cannot be called into action without dragging with it the participation of the other. For example, there is a perfect *συναλοιφή*, or interblending of influence, between the visual and muscular sensations, so that we are normally unable to perceive a colour that is not figured, or a figure that is not coloured; whereas it is quite common to perceive a figure that is not hot, and impossible to perceive the sonority of a colour. We can in Conception separate the feelings which are inseparable in Perception, and can therefore reason about colour without involving figure, so that an ideal separation of Properties is effected, and we do not conclude that what is true of the one must be true of the other.

PRIMARY AND SECONDARY QUALITIES.

40. Having these points clearly fixed, let us begin our investigation of the Properties of Matter by interrogating Experience, and enumerating what are the special feelings grouped in the abstract symbol. The positive qualities are, of course, all those qualities which we perceive in substances. To Perception, Matter is those qualities, and it is nothing else. We need not here consider the argument which proclaims that Matter is something underlying and not identical with these qualities; our present purpose is with the qualities themselves. The object now held in my hand, seen and felt by me as coloured,

figured, resistant, rough, smelt as fragrant, tasted as acid-sweet, I and my fellow-countrymen call a strawberry, and all men consider to be a substance, or portion of Matter. Reflecting on my experiences of other substances, and comparing these with the strawberry, I notice that it differs from them and agrees with them in the kind of feelings excited, and in the degrees of excitation. I class these feelings, and call the one set particular qualities, the other set general qualities; and on further comparison I find that, of the general qualities, some are universal. I thus form a general conception of Matter which has the universal qualities constituting its *essence* or definition, without which Matter would cease to be what the term signifies; and I form also the conception of this Matter under particular conditions, manifesting itself in relations which are temporary and incidental, these conditions constituting the essence or definition of each manifestation, and making each a substance. Iron, chalk, albumen, oxygen, wood, muscle, comets, and stars, are substances which are said to be material, because they have the universal properties of the universal Substance or Matter; but they are not recognised by philosophers as severally or together constituting Matter, because they are clogged with the products of our Sensibility, and Matter is said to be something else. Matter, say these philosophers, is not hot, coloured, fragrant, sapid, pleasant, harsh, &c., because these are feelings, states of our Consciousness, not states of the objects. These feelings are variable, and are known to vary, not only between individual organisms, but between different states of the same organism, the objects remaining unchanged all the

while; hence the conclusion that they cannot be properties of the objects. But there are some feelings which never vary, some properties which must belong to the objects, because without them we cannot conceive the objects existing. The properties which never vary are called the Primary Qualities of bodies; the properties which are variable are called the Secondary Qualities. Matter is thus supposed to be the source or substance of these Primary Qualities. When Consciousness is brought into relation with Matter, the Secondary Qualities result; but if there were no Consciousness in existence, Matter with its Primary Qualities would persist. Inertia, Impenetrability, Mobility, Extension, &c., would still be what they are.

41. This venerable tradition, still upheld by many thinking men, is destroyed by modern Psychology, which since the days of Berkeley has shown that the Primary Qualities are, equally with the Secondary, states of Feeling when viewed from the subjective side, and states of objects when viewed from the objective side. The valid and valuable distinction is not that one class stands for qualities of things in themselves, and the other for things in relation to us; but one stands for relations among things or feelings which are invariable (fundamental signatures), and the other for relations which are variable, conditional aspects. The source of our conceptions of Sweetness, Fragrance, Heat, &c., is the same as that of our conceptions of Extension, Impenetrability, &c.; both are raised from sensible perceptions; but the perceptions of the one class are special to special objects, while those of the other class are general, and belong to the

fundamental Signatures of Feeling. The Primary Qualities no more tell us what Matter is, apart from Sensibility, than the Secondary Qualities tell us it.

If we declare Extension to be an universal quality, this must not be understood to imply that it indicates a mode of Existence irrespective of Feeling, still less that it indicates what is *essential* to Matter in contradistinction to other qualities. Descartes and his school regarded it as constituting the whole essence of Matter; and metaphysicians since that time have been tolerably unanimous in regarding it among the Primary Qualities. What shall we say of it? That it is the objective side of one of the fundamental Signatures of Feeling; in other words, in all the reactions of Consciousness there is a quality of more or less voluminousness, indefinable as feeling, but definable by the conceptions of magnitude, extent, quantity, &c. This underlies the mathematical idea of Extension, which is more definite at the same time that it is more complex, and will not apply to the feelings of Fragrance or Sound, or to muscular and visceral feelings, in all of which the quality of voluminousness enters.

42. Strictly speaking we ought to confine the term *property* to Bodies, not to Matter; for an abstraction can have no properties; and it is the bodies which severally manifest the qualities. Now these bodies may be classed under general heads, and their qualities may then be pronounced general properties, or special properties, according to the genus or species. We do not say Vitality is a general property of Matter, but it is assuredly a general property of organised bodies; and these are grouped in the wider

class Matter. It may indeed be a question whether the abstraction Matter stands for more than a nominal or logical unity embracing concrete and various Reals, as Animal is the nominal or logical unity embracing myriads of concrete organisms. We do not believe nowadays in the existence of The Animal—a general organism which is no particular vertebrate or invertebrate; but we find it convenient to treat of the laws of Animality in the abstract, expecting to find these ideals realised (within due limits) in every particular organism, from the Amœba up to Man. These laws are said to express universal conditions of Life; they are differentiated into general and special laws in accordance with general and special conditions of organism and medium. But no biologist thinks of describing the simplest organisms as constituting the *essential* Animal because they manifest little beyond the universal laws of Growth, Reproduction, and Decay; no biologist asserts the more complex and special organisms to be less essential to the abstract Animal because the properties they manifest are individual and rare. He says that all the properties, general and special, are animal properties, because Animal is the abstract symbol which expresses the whole of the concrete facts observable in these organisms. The physicist should consider the properties of Matter in the same light, as the observed properties of particular bodies, and as the generalised synthesis of these. So that when he is asked whether Matter has this or the other attribute, quality, property, &c., he should separate the question into its real and ideal bearings, and frame his answer accordingly. Whether Matter among its groups of sensibles has or has not some one

sensible attribute—say Extension or Compressibility —is a question of fact, determinable by the very terms: Matter has this attribute, otherwise we should never have asked the question, for we could never have had the sensible experience of the attribute; but whether this sensible belongs to all *bodies*, or only to some, is to be determined by experiment.

43. But beside this generalised Notation of sensibles there is the generalised Abstraction of conceptions, which represents an ideal Matter different from that of perception, and is employed to render intelligible such discrepancies as that of continuity and discontinuity, divisibility and indivisibility, finity and infinity, &c. We postulate imaginary lines, and call them axes—imaginary points, and call them centres of gravity and poles—imaginary directions, and call them diagonals of parallelograms—imaginary clusters, and call them couples; and our explanations are aided by such fictions. Nay, if we are speaking of ideal Matter, we may lawfully declare that *it* has these attributes. It has them, if we think them. But our thoughts may not be true? Granted, if by truth be meant the conformity of thought with fact, the ideal with the real order. They are true when they correctly guide speculation, and lead to correct Action. What we have to bear in mind is, that the word *matter* is a symbol of various significates, and therefore in our interpretation, which is either the enumeration of observed properties, or of conceptions formed respecting these, we must be quite clear as to which of the significates we have in view.

Not to swell this chapter to an inordinate extent, I shall here only consider two or three of the Properties,

especially selecting those which have always occupied metaphysical discussion.

EXTENSION.

44. This is undoubtedly a property of Matter which, because it is one of the fundamental Signatures of Feeling, cannot be thought absent. By Descartes and others, it was held to be the essence of Matter; and as they contended that the universe was a *plenum*, consequently that Space, meaning empty Space, did not exist, there was not the contradiction in their view noticeable in the view of those who conceive Extension to be Space, and Space to be different from Matter. We must make up our minds either to identify Matter with Space, in which case Extension is a property of Matter; or else to separate them into two unallied independent existences, in which case Extension is not a property of Matter, but of Space; and what is signified in speaking of material extension is space-occupancy, which is a property reducible to Impenetrability, Resistance, or Repulsion, according to the point of view.

It has been said that Time and Space are conditions of existence, not qualities of existence.* I do not think these epigrams help us much. As I understand the case, Time and Space are abstract expressions of fundamental Signatures of Feeling, which are qualities in the concrete, and are raised by Reflection into abstract conditions. But however we regard them, the fact that we have certain sensible experiences which we group under the general symbols Time and

* GRUYER: *Principes de Philosophie Physique*, 1845, p. 106. SPENCER: *First Principles*, p. 169.

Space, suffices to prove these to be properties of Matter, since Matter means the sensible.

45. Extension, as known to us, is of three dimensions, and only three. Whether we are dealing with solids or with empty Space, we have no experiences out of which a fourth dimension could be constructed. The generation of each out of Motion is not to be mistaken. There can be no direction, distance, dimension, unless a mobile moves in that direction, and a sensation appreciates it. We are thus forced to introduce both Matter and Mind to explain the simplest fact of Extension. Whence the conclusion is, that Extension is necessarily a quality in Matter and a feeling in Mind. What it may be irrespective of either we can never know.

To geometers we leave the investigation of all that flows from this property of Extension; it is enough here to have indicated its place among the positively known properties of Matter. By even this brief statement we have shown that it is not the sole, nor even the cardinal property.

IMPENETRABILITY.

46. This has been the theme of interminable controversy. The word represents actual experience when it is made to signify the fact of Resistance, so that two bodies are unable to occupy the same space at the same time; however the one may compress the other, there will always be a limit to such compression, since, were this not so, we could by increasing the pressure destroy the very existence of a body. Not indeed an *assignable* limit, for bodies are indefinitely compressible; but that a limit must be postulated is evident from the impossibility of thinking a body compressed

to no bulk at all; because, if so compressed, it would cease to be; and so long as it is in being it must have the essential qualities of being. Now, whether we shift the meaning of the term from mass to the component molecules of the mass, or to the constituent atoms of the molecules, in either case we postulate the reality of that resistance to unlimited compression, which is but another aspect of the existence of the body. Incompressible occupation of space is therefore a quality inherent in our conception of the atom; Leibnitz therefore made this property take the place assigned by Descartes to Extension: "Materia est quod consistit in antitypia, seu quod penetranti resistit;" and elsewhere, "In hæc ipsa vi passiva resistendi ipsam materiæ primæ notionem colloco." *

Although we generalise our experience into a First Notion, and call Matter impenetrable, meaning that however much a body may be compressed—*i.e.*, its molecules pressed closer together—it will not be driven from all space, yet we have also abundant experiences which tell us that bodies are penetrable and ideally compressible, since we can thrust other substances between their molecules, and thus make one gas act like a vacuum to another. "We may cast potassium into oxygen," says Faraday, "atom for atom, and again oxygen and hydrogen in a twofold number of atoms; and yet with all these additions the matter shall become less and less in bulk till it is not two-thirds of its original volume. A space which would contain 2800 atoms, including 700 of potassium, is found to be filled by 430 atoms of potassium alone." Not only

* LEIBNITZ: *Epist. ad Bierlingium*, No. III., and *De ipsa Natura: Opera Philos.*, Ed. ERDMANN, p. 157.

gases and liquids admit of this penetration between their particles—all the solids known to us are porous; and the diamond or emerald will not only allow itself to be penetrated by light, but even by water! There is an exquisitely fine network of canals in the densest crystals, through which water can slowly filter.* Carbonic acid, if confined in a soap-bubble, will make its escape through the film, which absorbs the gas at its inner surface, and lets it pass through the outer surface.

On the ground of such facts it has been urged that Matter cannot have the universal property of Impenetrability, since every mixture proves its penetrability; and only where forces are in action which prevent mixtures can Impenetrability be said to arise.† This agrees with Kant's view of it as an occult quality: "For if one asks why matter in motion cannot penetrate other matter, the answer is, because it is impenetrable." Kant maintains that Matter is an "expansive force," by which, as Extension, it fills all space; and opposes the logical objection, that a substance in space must by the law of contradiction exclude the simultaneous presence of any other substance, with this remark: "This law drives no substance back which may be moving towards the space already occupied; only when I endow the substance occupying space with a power of throwing back every other substance can I understand the contradiction." ‡

The reader sees how the ground has been shifted from the positive to the speculative, and how the

* ZIRKEL: *Die Umwandlungsprocesse im Mineralreich*, 1871.
† APELT: *Die Theorie der Induction*, 1854, p. 122.
‡ KANT: *Anfangsgründe: Dynamik. Lehrsatz* 3.

words sometimes signify one mode of looking at things, and sometimes another. If a man says this diamond is hard, we understand him; if he says the diamond resists by its hardness all attempts to make another substance penetrate it, and occupy a portion of the space it now occupies, we also understand him; and when from this he concludes that all substances are resistant, and all more or less incapable of being penetrated, he has the speculative justification derived from the axioms that a thing cannot be and not be at the same time, and that since space-occupancy is essential to existence, whatever exists resists and is impenetrable. All the facts which seem to prove penetrability only prove that the particles are mobile and separable, not that the particles themselves are penetrable.

INFINITE DIVISIBILITY.

47. We are here landed before the vexed question of Infinite Divisibility. The facts which warrant our assertion that Matter is penetrable in respect of its masses and molecules, involve the corresponding assertion that Matter is divisible in its masses and molecules. The facts which warrant our assertion that Matter is impenetrable in its resistant existence, involve the corresponding assertion that there is a limit to the divisibility. Its atoms or ultimate elements are *ex vi termini* indivisible. But are there such atoms? This is a delicate question. It cannot be entered upon at present, but we may consider what is the bearing of the argument commonly applied respecting the infinite divisibility of Matter, which is one of the famous antinomies of Reason urged by various philosophers against the validity of Reason.

The contradiction is patent in the ordinary statement. Matter is said to be essentially extended, and Extension is infinitely divisible, since it has magnitude, and there is no magnitude which cannot be *conceived* capable of division into lesser magnitudes. No sooner is a point reached which is taken as ultimate, than the process of subdivision is conceived as equally applicable to it. Not that human powers of physical division are unlimited, but the conception of divisibility without end is involved in the conception of Extension. There is no assignable reason why the process of subdivision should cease at any point, although there may be valid reasons why our power of physically effecting such subdivision should cease. Thus we examine a body, and find it to be composed of separable parts. We grind it into powder: that body which a moment ago was a solid mass of definite form, is now an indefinite heap. Each particle of that heap is a small mass of particles, which also may be separated by mechanical means. When the limit of mechanical separation is reached, we have the molecule—an extra-sensible, but supposed to have all the properties of particles and masses. This is the *molecular limit.* We can indeed ideally separate this molecule into its constituents, as we physically resolve the molecule of water or of chalk into the gases which constituted it. But in tearing asunder these united atoms of gases we have not *divided* the molecule, we have *destroyed* it—we have passed beyond the limit of water or of chalk, and entered upon a new form of existence. Whether the molecules of gas are or are not divisible into components and constituents, as the particles of water were divisible into components and constituents, is a

question not to be answered at present; but granting that future discovery may reveal the composite nature of the so-called elementary gases, we must still maintain that each molecule of gas is the limit of divisibility, beyond which the gas molecule ceases to exist *as* gas molecule, and becomes something else.*

But, it will be said, however you fix the limit, your molecule and your atom have magnitude, and all magnitude is infinitely divisible. The fallacy here lies in applying one category to another, and treating Quantity as if it were the same as Existence, arguing from quantities to things quantified. Leibnitz thought this probable: "Non omnino improbabile est materiam et quantitatem esse realiter idem;" and Hegel, who quotes this, remarks: "Quantity is the purely subjective attribute (*die reine Denkbestimmung*), while Matter is the same thing in outward existence."† But it is one thing to admit that Quantity is an inseparable attribute, another to assume that what is true of one attribute is true of the total of attributes. If we abstract the attribute of Quantity

* "Unless there be something indestructible and indivisible in sodium, how can it happen that every little fragment shall retain every physical property of sodium, so that, for instance, when glowing with heat it shall continually, as it were, ring out the same notes of light, imparting such vibrations to our eye as paint the well-known sodium line? If we would divide the little bodies which, vibrating at these special speeds, prove sodium to be glowing in the flame, they would no more vibrate at those speeds than a cut violin-string would give out the true note to which it has been tuned. By such division sodium would be destroyed; whatever might be the result, the body named sodium would exist no longer."—*North British Review*, March 1868, Art. *The Atomic Theory of Lucretius*, p. 216. And why would the sodium exist no longer? Because it would no longer embody that "greeting of the spirit" which made it specially sodium and not something else: the subjective factor would be changed.

† HEGEL: *Logik*, i. 207.

from all the others, and operate on this abstraction, we are not thereby operating on the reality. It is an ideal, not a real operation. The infinite divisibility of Matter is not more rational than the infinite visibility of Matter; and this under both aspects. Under the first aspect, in which Matter is not the Sensible, but an abstraction, we can no more divide this abstraction than we can see it. Under the second aspect, in which Matter is the Sensible, we know that it is divisible and visible only within limits. Although the *minimum visibile* to us may not be the limit of visibility to other eyes; and although the limit of effective divisibility may be passed when greater powers are applied, yet for every possible eye there must be a limit, beyond which vision cannot pass, since a definite amount of energy will be requisite to disturb the equilibrium of the nerve centre, and any less amount will be inappreciable.

48. The question is therefore absurd. Instead of asking, Is Matter infinitely divisible? we might ask, Is it divisible at all? and if so, under what conditions? To answer these questions we must settle *what* it is that we are supposed to divide? Not the abstraction, surely; or if so, our division is but an abstraction. Not the abstraction Matter, but some concrete object. The abstraction Number is not divisible, unless we choose to regard its resolution into integers as a division: each integer is not itself divisible, though resolvable into fractions; each integer and each fraction has its definite limit, beyond which the integer or fraction ceases to exist. To continue the division is an artifice of Calculation, but we thereby quit the ground of reality,

and have *shifted our terms in shifting the limits.* This may be apparent in another case. The existence of the English Nation is a complex fact which may analytically be presented in its subdivision of classes, families, and individuals. The classes and families are the components of this mass; the individual men, women, and children are the constituents. We may divide the Nation into its social units, or families: here is one limit. We may divide each social unit into its constituent members: here is another and a final limit, beyond which the process of subdivision cannot pass without destruction of the conception Englishman, as a constituent of English Nation. It is true that, shifting our ground and introducing new terms, we can proceed with this analysis of wholes into parts, we can resolve the individual organism into component organs, these organs into constituent tissues, these tissues into component parts, and constituent elements, and thus we arrive at the biological limit. The chemist takes up the analysis here, and resolves the biological elements into proximate principles, these again into constituent principles, and so on. The organism, the organ, the cell, the proximate principle, the gas, each is a limit.

49. The mistake of concluding that what is true of a whole must be equally true of its parts (see RULE IX.), without due explanation of whether what is asserted in both cases preserves the necessary homogeneity of the terms, has led some philosophers to the conclusion expressed by Euler, namely, that if infinite divisibility is a property of Extension in general, it must necessarily belong to all the extended individuals.

Let us try and extricate the truth from the fallacy here. The divisibility which is predicated *in general* lies in the mathematical conception of Extension, involving among its terms the conception of parts, and consequently of partition or division into parts. Within this ideal region all is clear, demonstrable. The terms are expressed distinctly, and the conclusions are but re-statements of the terms. Very different is the meaning of divisibility which relates to things, as complex reals, and not simply as abstract quantities. That means to separate parts from parts, a separation which destroys the whole as a particular and perceivable real, although retaining the general conception of a whole composed of such parts. When we divide 10 into 5 and 5, or a bar of iron into a heap of iron filings, we can indeed ideally recompose these parts, and conceive the parts to be the original wholes under new aspects. But this is an ideal reconstruction. The reals are so markedly different that they have lost many of the distinguishing properties of the wholes, and acquired properties not manifested by the wholes. We have only to consider how useless the heap of iron filings would be for most of the purposes to which the iron bar can be applied, and how the filings are so combustible that they spontaneously take fire in oxygen or chlorine, whereas the iron bar is only rendered incandescent by great heat, and we shall at once recognise the difference between the two reals, bar and filings. There are many ways in which the properties of a mass differ from those of its molecules; the chief of these is, that some properties are *emergents* not *resultants*; another is, that individual effects which are neutralised or balanced in the mass become resultants in the divided

mass; just as the individual action of a man is merged in the general action of the nation, becomes prominent in the action of the parish board, and predominant in that of his family. The water-wave advances towards the shore, but the particles of this wave do not advance: the whole is a *moving form* traversing the surface of the lake; the parts are stationary movements, oscillating to and fro about their centres. Again, the very direction of the movements is different in the wave and its parts, for the parts move in circles; *they* move up and down, while *it* moves forwards. Thus may the paradox be reconciled of a visibility emerging from invisible molecules, and divisibility being the property of a mass of indivisible molecules.

50. If we interrogate Experience, the answer is clear: Substances are divisible, *i.e.*, separable into parts, but the divisibility is limited. It is so in two aspects—the separation is only a *redistribution* of the parts, a redistribution which destroys the original group without affecting the reality of the components, so that the sum total of their amounts remains constant; and if we effect a further redistribution, we are only shifting our arbitrary limit. Secondly, there are limits even to this process of shifting the limits; for since what *we* know as Matter has no existence isolated from Consciousness, and since Extension is one of the fundamental signatures of Feeling, having degrees or quantities, it is clear that we can never have a perception nor a conception of Matter from which this inseparable element of limitation is eliminated. In the two aspects, therefore, positive and speculative, we must regard Matter as *divisible into indivisible parts.*

51. The so-called antinomy of Reason which pretends that Matter must be conceived as infinitely divisible, although infinite divisibility is unthinkable, must be rejected; it is a logical juggle, confounding operations on abstract Quantity with operations on concrete Reals.

INDESTRUCTIBILITY.

52. The preceding observations have to a great extent anticipated the line of argument applicable here. The indestructibility of Matter is now a scientific axiom; without it Science would be powerless, for Calculation would be vain. Yet it is by no means an axiom of Common Knowledge; so far from it, that, according to ordinary experience, Matter is daily destroyed, when bodies vanish from our sight and touch. This discrepancy is indeed explained by Science, and the apparent destruction is shown to be only a transformation; but the old belief still lingers in the tradition that Matter was created, and will be finally annihilated.

Here then on the one side we have a First Notion, which assuredly represents some truth of Experience, and on the other side a Conception directly at variance with it: a truth not only accepted by all scientific thinkers, but by some declared to be *à priori*, and in no way born in Experience. How are we to reconcile these views? By the same principle invoked in the analogous cases of penetrability and impenetrability, divisibility and indivisibility. Two very different significates are expressed by one and the same sign. The Matter which is declared to be indestructible is not the Matters known to be destructible, not

the sensible substances, but their logical synthesis, or their imaginary Substratum. The sensible substances, objective groups, vanish and reappear under changing conditions. The Matter, or abstraction of these sensible Reals, the logical synthesis of these qualities objectively viewed, is called the Matter *of* these Reals, the Substance of which they are the Forms; and *this* remains unchanged throughout their changes. This piece of wood is only a Form which vanishes when the wood is burnt into gases; but the Matter *of* which it was the Form reappears under other Forms. There has been a transformation, not a destruction. The proof offered is both experimental and theoretical. Experimentally we learn that the gases which replace the wood have (or *are*) precisely the same sum of Force, measured in units of Weight; and they manifest those properties of Resistance, Pressure, Mobility, &c., which characterise Matter. Theoretically we learn that Matter, conceived as Existence, must be indestructible, because we are unable to conceive it passing into Nothingness. We cannot form a conception of any annihilation which is not a transformation, and therefore, since the non-existent can never be an object of Sense, it is unthinkable because unimaginable, and the indestructibility of Matter is an *à priori* truth.

53. Having stated the argument to the best of my ability, I will now criticise it. First note the ambiguity of saying that the idea of destruction is unthinkable, in the face of the fact that for centuries it has been thought. This has been evaded by the assertion that "men did not really think the idea, they only thought they thought it." But this is to confound Con-

ception with Imagination. In almost every thought, idea, conception, there are over and above the condensed perceptions capable of definite expression in terms of Sense, elements incapable of such expression; in other words, there are sensible experiences which can, severally or in groups, be reproduced in images; and there are products of such experiences which cannot be reproduced in images, because they never were distinct *objects* of sensible perception. It is therefore quite possible to think precisely what we are unable to imagine otherwise than vaguely. My idea of the Infinite, for example, is precise, and not to be confounded with any other idea; but although I can reason on it, I am utterly incapable of *imagining* the Infinite. My idea of a million is definite, and not to be confounded with any other number, however small the difference between the two. I reason with it, calculate with it, but can form only the vaguest image of it. My idea of a mathematical line is sharply defined, but I am wholly unable to form a mental image of a line without breadth. Here then are three conceptions, each having its sensible basis, which basis is imaginable (namely the sensible experiences of continuously shifting limits, of units summed, and of lines becoming fine by degrees), and a superadded element which is unimaginable, and these three products of mental processes are thinkable although unimaginable.

54. Is the conception of Non-Existence interpretable in the same way? It is certainly not imaginable; but Hegel was only ambiguous when he said, "The Nothing *exists*, for it is a thought." It does not exist in the sense of being a Real which itself directly affects Feeling, but in the sense of being an idea

which symbolically represents actual experiences. Not Here is the correlative of Here, Not Self of Self, Non-Existence of Existence. The sensible fact of *negative* experiences is generalised and expressed in the abstract symbol of Negation; and we can deal with this as with other symbols. When a man says, "There is nothing in this box," he has a perfectly definite meaning, which may be interpreted, "There is nothing which I can see or feel in the box." Corrected, and told that there is a thing in the box, namely air, he will answer, "Very well, air if you please; but there is nothing else." If again corrected, and told there was ether, and, besides the ether, space, he would say, "What you call space, I call nothing —what I mean by nothing is the absence of a sensible thing."

In the conception of a mathematical line there is a sensible experience and an intellectual experience or abstraction; and so in the conception of Non-Existence. By diminishing the breadth of the sensible line we can ideally reduce it to zero: this zero cannot be imagined, but is conceived. By extending the sensible experiences of destruction and negation we can ideally reduce a substance to zero, also unimaginable, yet thinkable. We do not suppose either conception to be a transcript of a Real. We cannot affix positive predicates to negations. But if we employ the symbols with due regard to their significates, they will be useful, and not dangerous.

55. When therefore it is argued that the creation of Something from Nothing or its reduction to Nothing is unthinkable, and is therefore peremptorily to be rejected, the argument seems to me defective. The

process is thinkable but not imaginable, conceivable but not provable. Whether such a process is or is not to be admitted among the possibilities of a world outside our Cosmos, may be left to Metempirics; all that Science, and the Philosophy which adopts the canons of Science, can say is, that we have no evidence either of creation or annihilation; but, on the contrary, all our positive evidence points to evolution and *re-distribution.* We cannot have experiences which would justify the conclusion that Something ever did arise out of Nothing, or could ever pass into it; and this for the simple reason that all experience must be one of sensibles, and the Nothing is not sensible. When, therefore, Hegel makes the Nothing co-ordinate with Being, and out of the two evolves Existence as the Becoming, he commits the logical error of assigning positive values to the negation of all value. If the *Nichts* is zero and *Seyn* has any value, then by combining them we get $0 + 1 = 1$; and, if neither have any value until combined, then we have $0 + 0 = 1$, which is an equation to make a mathematician stare.

56. However it is not for the purpose of criticising Hegel that these remarks are made, but to lead up to the position that the axiom of Indestructibility is not an *à priori* truth, but an induction from experience; and, like all inductions, it assumes the homogeneity of its terms. It cannot be proved, if transcendental proof be demanded. Firstly, because if under the manifold transformations there were not only a dissipation of energy but a destruction of it, the quantity destroyed in each case might be too small for appreciation by any means in our power; and we already know that in ordinary balances small differences are

not appreciable, whereas balances have been devised which respond to differences of a millionth, and the spectroscope reveals quantities so small as the hundred and eighty millionth of a grain. Secondly, because Non-existence could not be rendered sensible, and the quantity of Matter which disappeared from observation might be simply dissipated into insensible states. Nevertheless, in spite of the unprovable nature of the induction, the Indestructibility of Matter is a conception which expresses our positive experiences with greater fidelity than any other assumption. If we understand by Matter one pole of the great magnet Existence, the other pole being Force, then the axiom is not to be disturbed. But if with so many philosophers we understand Matter to be the manifestation of an unknown Force, then the axiom becomes questionable, and Matter like other manifestations will be destructible, for we cannot then say that Matter *is*, only that it *appears* in its manifestations, and will *disappear* when they vanish. We resolve one substance into other substances, one form into others; and if we assume that underneath these changing forms unchanging Matter persists, it is because we identify Matter and Force; on the other hand, if we assume that Matter is the efflux of Force, *its conditioned manifestation*, then we must suppose that *it* is destroyed whenever the *conditions* change, and when it is, so to speak, withdrawn into the bosom of Force. By some such process men conceive the world to have sprung from Nothing by a creative fiat, and believe that it will pass away again.

57. Here, as elsewhere, we observe the impracticability of dissociating the ideas of Matter and Force. All the

alleged proofs of the indestructibility of Matter are proofs of the *redistribution of Force*, with constancy in the total amounts. Yet note the curious fact, that while the indestructibility of Matter was a conception reached by some of the earliest Greek thinkers, the indestructibility of Force has only in our own time been generally formulated as an axiom. Both may be demonstrated of ideal conceptions; neither can be proved to be true of Reals. We can never prove that in the dissipation of Energy there is no loss, only redistribution; we are, however, constrained to assume it, simply because we are unable to form a mental picture of the passage of Existence into Non-existence; and all our proofs rest on this assumption. Thus, to take a special instance: if a body be heated so as to make it pass through a series of states, defined by the temperature and the volume of the body in each state, and if then allowed to cool so as to pass through exactly the same series of states in the reverse order, the quantity of heat which entered during the heating process is equal to the quantity which left it during the cooling process. Professor Clerk Maxwell tells us that by those who regarded heat as a substance this was held to be self-evident; but although true, as stated, yet if the series during the heating process is different from the series of the cooling process, the quantities absorbed and emitted may be different. "In fact, heat may be generated or destroyed by certain processes, *and this shows that heat is not a substance.*" * But may not the same line of argument be urged in proof that heat is not a force? This difficulty is only evaded by calling it an energy, and assuming the indestructibility

* MAXWELL: *Theory of Heat*, p. 57.

of the Force which manifests itself as Energy. Thus the final proof rests on the assumption expressed in the Law of Invariants (PROBLEM I. chap. vi.)

GRAVITY.

58. There is little need to dwell on this property. It is regarded as universal; although if Ether be admitted to be Matter, and imponderable, we are obliged to regard its gravity as a theoretic assumption displacing Observation. This is permissible, because the law of gravitation is an ideal conception, not a real transcript of Observation.*

Gravity is isolated from other properties, and held to be a quality rather than a force; and among forces it occupies the peculiar position of being independent of all relations except those of mass and distance. Light, heat, electricity, &c., have their manifestations modified by the internal structure of the bodies, and the external relations of surrounding bodies; but in gravity the units of mass and distance are the sole co-operants. Its variations depend on these. Gravity cannot be intercepted, reflected, refracted, polarised, nor turned from its path in any way. Its action is

* "Son action," says POISSON, "s'exerce sur toutes les parties de la matière dans les directions perpendiculaires à la surface de la terre, ou suivant les lignes verticales. Les directions prolongées de la pésanteur en differens lieux iraient donc concourir au centre de la terre à cause de sa forme à très peu près sphérique ; mais en ayant égard à la grandeur du rayon terrestre relativement aux dimensions des corps qu'on a ordinairement à considerer on peut supposer, sans erreur sensible, la pésanteur parallèle à ellemême dans toute l'étendue d'un même corps. . . . . A parler rigoureusement la gravité n'est pas la même pour toutes les parties d'un même corps à raison de la difference de leurs distances à l'équateur et au centre de la terre. Neanmoins on conçoit que dans une aussi petite étendue la variation de l'intensité de cette force peut être negligée, comme celle de sa direction."—*Traité de Mécanique*, i. 119, 20.

said to be instantaneous; but that is not beyond doubt. Light was also said to be instantaneous till its velocity was measured; and if gravity is, as some hold, a residual phenomenon of electricity, if it is a transmitted force, the transmission must involve space and time. Laplace calculated that its velocity, if admitted, must be fifty million times greater than the velocity of Light—so that we may call it instantaneous. On the hypothesis that gravity is not a transmitted force, but a constantly acting pressure, it must be both universal and instantaneous.

INERTIA.

59. This is the last of the properties we shall notice. It is eminently equivocal, for although always reckoned among the universal properties of Matter, it is also treated as an abstract force. We can trace its genesis from a First Notion to a mathematical Conception. The observed facts of bodies in movement coming finally to rest was interpreted by the early speculators from the only source then opened to them, namely, their consciousness of fatigue, and desire for repose after exertion. Bodies were supposed to get tired by motion. Since our own bodies were only moved by an effort, and sank into repose when the effort was relaxed, all bodies were supposed to be inert, and movable only by external agencies. This First Notion gradually gave place, through successive approximations, to the mathematical conception of a Law of Motion, which, itself a fiction, drove out the fiction of fatigue. The Law, as I have said before, is an ideal construction, not the transcript of observed fact. What is observed is, that one motion will be com-

pounded with another; and if the directions of the two be opposite, and their amounts equal, the resultant will be rest. The effort we feel in moving our own bodies, or in moving others, is due to the resistance which their *resultant* movements opposes to the direction we endeavour to impress on those movements. Statics are only cases of Dynamics (more strictly of Kinematics), and Rest is equilibrium of Motions.

60. The ancients had no clear ideas on this subject, and their modern disciple, Lord Monboddo, undertook to prove that the Law of Inertia was not true, because it was absurd, he said, to talk of a *state* of motion (motion being change), and absurd to suppose things so opposite as Motion and Rest could be of the same law.* Descartes held that Inertia was the absolute indifference of Matter to motion or rest. The objection to this is, that it formulates a pure negation, not a positive quality; but it was widely accepted, and we read that "it is self-evident that the fundamental character of Matter being lifelessness, there can be no internal, only external, sources of change in its state," which is a corollary from the axiom that all change is necessarily from without. But the question is, What is the nature of this change? Is it the passage from inactivity to activity, inertness to movement; or is it the variation in direction of an activity which is unchangeable? Is Matter always moving, though not always changing its relative position in space, but varying in the directions of movement; or is it an inert mass, which, destitute of Force in itself, is moved only by an outlying agency? Newton held the ultimate particles of Matter to be endowed with a *vis*

* MONBODDO: *Ancient Metaphysics*, ii. 336.

inertiæ, which was "accompanied by such passive laws of motion as naturally result from that force." His reasoning, however, seems questionable when, after defining Inertia as a "passive principle by which bodies persist in their motion or rest, receive motion in proportion to the force impressing it, and resist as much as they are resisted," he adds, "by this principle alone there never could have been any motion in the world." Surely if every particle had its own force there would have been precisely the same amount of motion; and surely the *varieties* of motions (directions and velocities) which exist are only *redistributions* of that constant amount. We cannot entertain the idea of an independent Motion which is to be here and there superadded to Matter, an Active Principle or Agent which operates on Inactive Substance; nor can we reconcile Newton's clearly-expressed doctrine respecting Motion, especially its first law, with his statement "that some other principle was necessary for putting bodies in motion, and *now they are in motion, some other principle is necessary for conserving motion.*" What other principle beyond that of Inertia, or Persistence, is necessary for conserving the motion of a body unopposed by contrary motions? Nothing can be more explicit than the language of the *Principia*, "All bodies are movable, and by a certain force, which we call *vis inertiæ*, continue in a state of motion or rest;" to which must be added that Rest is itself balanced motions.

61. Modern science takes for granted that the molecules of Matter are always in movement (vibrating), though these movements may be imperceptible. Thus the velocity of a locomotive is the resultant of the

percussion of the innumerable molecules of steam on the piston. Masses are also always in movement, although not always changing their relative positions in space. Modern metaphysics likewise takes this for granted, since it refuses to separate Force from Matter otherwise than as two abstractions. Aristotle defined Matter, "the movable in space;" and if for our logical and grammatical convenience we separate the *motion* from the *thing moving*, we do not therefore assume a real separation corresponding to it. In *this* abstract sense it is a *contradictio in adjecto* to speak of Matter having internal or external motion—*vis inertiæ*—or activity of any kind: Matter here is the abstraction of Passivity, the subject to which the predicate Activity is logically ascribed. But no sooner do we restore the rejected element of Force, than our conception of Matter involves that of its essential Activity, and the conception of its inertia is that of the constancy of force, the indestructibility of Existence. The Newtonian doctrine regards inertia as the persistence, the passive side of Matter: and *vis inertiæ* as the resistance of that persistent force, the *active* side of Matter. Thus we may interpret the language of Maclaurin: "Body not only never changes its state of itself, in consequence of its passive nature or *inertia*; but it also resists when any such change is produced. . . . . This force with which it endeavours to persevere in its state, and resists any change, is called its *vis inertiæ*, and arises from the inertia of its parts being always proportional to the quantity of Matter in the body, insomuch that it is only by this inertia we are able to judge of the quantity of matter."*

* MACLAURIN: *Discoveries of Sir Isaac Newton*, p. 104. "L'inertie

62. Here, as elsewhere, we see Inertia identified with Matter. The two fundamental ideas of Matter and Force are the ideas of Existence and Change. "Force cannot exist without Matter to act on," says Whewell. "Matter cannot exist without Force to keep its parts together, and to keep it in its place. But Force acting upon matter may be either Force producing rest, or Force producing motion. If we consider Force producing motion, the motion produced, that is, the velocity produced, must depend on the quantity of matter moved. It needs must be that the same force produces a smaller velocity in a larger body. The measure of the degree in which the body then resists this communication of motion is inertia. And the inertia is necessarily supposed to be proportional to the quantity of matter, because it is by this inertia that this existence and quantity of matter is measured." * What is called overcoming inertia is altering the conditions in which a body is at any moment, and by this alteration producing a new resultant; but through all changes of the resultants there is the persistence of unchanged quantities of Matter or Force. The inertia, or resistance to motion, of a rock is proportional to the amount of matter in that rock, whether that rock be so nicely balanced that a lady's finger can move it (as a rocking-stone), or be so firmly and broadly based that a thousand horses

n'est qu'une propriété qui ne peut entrer dans un calcul," says CARNOT, and truly, for inertia is an abstraction; "mais la force d'inertie est une vraie quantité susceptible d'une appréciation exacte. L'inertie est simplement la propriété qu'a chaque corps de rester dans son état de repos ou de mouvement uniforme et rectiligne; et la force d'inertie est la quantité de mouvement que ce corps imprime à tout autre corps qui vient le tirer de cet état."—*Principes de l'Équilibre et de Mouvement*, p. 73.

* WHEWELL: *Philosophy of Discovery*, p. 329.

cannot move it. If we say of the rocking-stone that its inertia is easily overcome, we ought to be understood to say that its conditions of equilibrium are such that a very small difference will appreciably alter it. The lady's finger pressing against the rock is opposed by a counter-pressure of great force; when it is pressing against the rocking-stone, there is but a trifling counter-pressure; and there are mechanical reasons explaining the conditions of both.

63. Inertia is the symbol for the constancy of an existence under constant conditions, a symbol of the statical condition, as Motion is of the dynamical condition—a symbol of Passivity correlated with Activity. The conception of Matter absolutely indifferent to Motion or Rest is a pure artifice. If it were true, any impulse from without would communicate its velocity to every body struck, and this with no loss on the part of the striking body. This is not so. Every body has its own intrinsic force, balanced or free, which reacts on the impulse, blends with it, and the resultant motion or rest is the product. Leibnitz well says, "Tout ce qui pâtit doit agir réciproquement et tout ce qui agit doit pâtir quelque réaction."* This is Newton's third law. If we say that a body at rest is indifferent to rest or motion, this is true only as an expression of the fact that it will not change its state unless the conditions of change be introduced. When at rest, there is a balance of the moving forces: the arrested motions of the molecules are ready to start into salient motion, directly any external change in the conditions disturbs this balance. No internal change can arise in

* LEIBNITZ: *Opera, ed.* ERDMANN, p. 113.

these arrested motions so long as they are what they are; the balance is their equation.

64. Poisson, after defining inertia, adds; "Ce mot ne signifie pas que la matière soit incapable d'agir; car, au contraire, chaque point matériel trouve toujours dans l'action d'autres points matériels, mais jamais en lui-même, le principe de son mouvement."* For movement there must be change of position; for change of position there must be at least two related terms; therefore one body, if we conceive it to be isolated, and not related to any other, could be neither moving nor resting. In this imaginary independence of all relation, Matter would of course be indifferent to motion and rest, and incapable of either. In reality there is no such unrelated body; there are bodies mutually dependent, mutually active. It is this necessity for the introduction of an external movement, as a second term of the relation, to render change thinkable, which has originated and justified the mathematical fiction of Matter as necessarily inert, in contradiction to the metaphysical conception of it as necessarily active, in so far as it is identical with Force. In the Discours Préliminaire to his treatise on Dynamics, D'Alembert remarks, that since all we distinctively see in the movement of a body is that it traverses a certain space in a certain time, he declines altogether to consider the motor causes, confining himself to the motions produced. "J'ai entièrement proscrit les forces inherentes au corps en mouvement, êtres obscurs et métaphysiques, qui ne sont capables que de répandre les ténèbres sur une science claire par elle-même."* As a mathematician, he was assuredly

* Poisson: *Traité de Mécanique*, 2d ed., vol. i. § 113.

in the right; but if this analytical procedure was imposed on his science, it did not affect the synthetical and metaphysical question. Afterwards he says that all the proofs hitherto urged in support of the conservation of movement want the necessary degree of evidence, because they are founded either on a "force qu'on imagine dans la matière par laquelle elle résiste à tout changement d'état, ou sur l'indifférence de la matière au mouvement comme au repos;"* and he rejects the first of these, firstly, because it supposes in matter "un être dont on n'a point d'idée nette;" and, secondly, because it will not suffice to prove the law.† Yet the metaphysician might answer: I can form a clear idea of this inertia by the aid of the axiom of the constancy of existence under constant conditions; the identical proposition that a thing is what it is, will assure me of the conservation of energy.

65. Comte regards the Mathematical fiction of Matter being inert as absolutely indispensable to the science of Motion, though admitting that it is commonly "so ill expressed that one knows not whether this passive state is purely hypothetical or represents reality; whereas we must distinctly bear in mind that it is a pure abstraction directly contrary to the veritable nature of things;" in other words, it is an analytical artifice, to be rectified in synthetical appreciation. In early days philosophers naturally regarded Matter as essentially inert; all activity was thought to be impressed on it by the agency of external entities. These entities gradually gave place to forces, also

* D'ALEMBERT: *Traité de Dynamique*, 1796, p. xv.

† *Op. cit.* p. 7.

supposed to be external agents.* Then arose the mathematical conception which regarded Motion in the abstract, without reference to its modes of production; and according to this artifice we replace at will any force by any other capable of producing exactly the same motion; and, by the same principle, we replace all the movements of the molecules by their resultant, and every change in this resultant by some external force which is more than their equivalent. Whether a falling body be impelled by some internal energy (the resultant of its own molecular forces) or by some external agency (gravity or pressure), the result is what we measure and take heed of. But there are obvious analytical advantages in regarding the change as due to an external, easily measurable, force, acting on an inert body, although we know the body not to be inert, but to *react* according to its mass and acceleration.

66. If we start from two assumptions—1°, that Matter is indestructible; 2°, that no atom, no mass, can move in two directions or with two velocities at one and the same time, we shall by these explain

* "In a rude age, before the invention of means for overcoming friction, the weight of bodies formed the chief obstacle to setting them in motion. It was only after some progress had been made that men's minds became practically impressed with the idea of mass as distinguished from weight. Accordingly, while almost all metaphysicians who discussed the qualities of matter assigned a prominent place to weight among the primary qualities, few or none of them perceived that *the sole unalterable property of matter is its mass.* At the revival of science this property was expressed by the phrase 'inertia of matter;' but while the men of science understood by this term the tendency of the body to persevere in its state of motion or rest, and considered it a measurable quantity, those philosophers who were unacquainted with science understood inertia in its literal sense as a quality—mere want of activity, or laziness."—CLERK MAXWELL: *Theory of Heat*, 1871, p. 85.

Inertia as the constancy of Matter, and shall no more require the fiction of absolute inertness (in the sense of passivity) than we require the fiction that bodies are "without weight" when they are equally balanced. Each atom, molecule, or mass has its indivisible unalterable quantum of Force (Activity), which may, indeed, be compounded with that of others, so as to produce an increase in any one direction, or to produce the rest of equipoise. The mass presses downwards with a constant amount, whether it is balanced by an equivalent mass or falls on the removal of the equipoise.* Being incapable of acting in two directions at the same instant, it acts either in balancing some equivalent mass or in falling.

We can therefore assign a dynamical principle in explanation of Inertia, without recourse to the fiction of inactivity—namely, we declare it to be the resistance to a change of direction, the resistance being simply the contrary direction of the body which has to be changed. The body is occupied in one direction, and cannot be occupied in two; the measure of its resistance to a change of direction is the amount of its mass and velocity along this line. Laplace has offered an explanation which is certainly open to the criticism urged against it by Comte. He says, "A body at rest cannot move itself, because it does not contain within itself any reason why it should move in one

* "L'action est constamment égale à la réaction dans tout mouvement où la force est constante; et par conséquent aussi dans le cas où elle est variable, puisqu'on peut toujours la considérer comme constante dans un intervalle de temps infiniment petit. C'est cette réaction qu'on appelle force d'inertie."—DUHAMEL: *Des Méthodes dans les Sciences de Raisonnement*, 1870, iv. 252.

direction rather than in another."* Comte remarks, "How could we be assured that there is no reason for a body's movement? What can we know on this point, otherwise than through experience?"† It seems to me that if Laplace had simply said, "A body cannot deviate from its direction without a cause of the deviation," he would have expressed both the fact of Perception and the law of Conception, without embarrassing the question with the assumption that a body cannot move itself — an assumption in contradiction of the idea that every body is moving in virtue of its own activity. To deviate from any direction, a body must have its motion compounded with another. To say that a body at rest "contains no reason" why it should move in one direction rather than in another, seems as uninstructive as to say that the diagonal of a parallelogram of forces contains no reason in itself why it should not be a parabola. The body at rest is exerting force in the one direction which balances all the forces in a contrary direction; and because the force is thus occupied it cannot be otherwise occupied at the same instant; the diagonal cannot take any other direction, because it is the resultant of the components which, if each moved separately, would describe a parallelogram and not a parabola.

67. The reader who may have grown impatient over this examination of the opinions entertained by philosophers and mathematicians, will perhaps acknowledge that there was good justification for it when he reflects that, on the one hand, the conception of the

* LAPLACE: *Système du Monde*, 1836, i. 275.
† COMTE: *Philosophie Positive*, i. 558.

essential inertness or inactivity of Matter has a misleading influence in Speculation, by sustaining the traditional conception of Matter and Force as two separate Agents; and, on the other hand, that the splendid results of mathematical treatment tend to make its analytical artifices take the place of real experience.

68. In closing this survey of the properties, I must remind the reader that there has not been the faintest idea of treating the subject exhaustively, but only of indicating the proposed mode of applying our Method, by reducing each question to its positive and speculative terms. A complete solution of the Problem of Matter is, of course, hopeless, since our knowledge of the properties is always advancing, and with each step in advance a variety of new problems present themselves. But a general solution is attained when we have determined what Matter is by determining what its general properties are, and when we have clearly marked out the distinction between Matter positively known through the reactions of Feeling, and speculatively known through the transformation of perceptions into conceptions.

CHAPTER IV.

THE NATURE OF MATTER.

69. THE solution sketched in the foregoing pages affords no answer to the (irrational) question, What is the nature of Matter *in itself*, and apart from its properties? Those readers who have grasped the leading purpose of this work will have recognised the irrationality of the question, and will have seen that to know the properties of Matter is to know what Matter is. The logical distinction of the abstraction from its concretes is a convenient artifice; but the subsequent erection of the abstraction into an independent existence is a speculative illusion fraught with danger. It is aided by the natural desire to extend knowledge, and by the metempirical desire to get *behind* the phenomena—a desire which leads to an interminable regress, since there will always be an equal justification in attempting a *why* of the *why*, a cause of the cause, unless the mind acquiesces in fixed ultimates. What are the ultimates? Since knowledge is classification of observed phenomena, a systematisation of the Known, not a divination of the Unknown, the ultimates of Feeling are the fixed limits of research; and carrying the Logic of Feeling into the higher region of the Logic of Signs (which are only signs of feelings), we there find the ultimates of Speculation to be those

equations which express what may be called the *forms of the functions* (see vol. i. p. 178)—all Observation being simply of the functions of the unknown quantities. Stated in a less abstract way, it may be said that all we can positively know of anything, cosmical or mental, is how we are affected by it; and the various Provinces of Feeling (§ 39) are so many ultimate divisions, while the various Conceptions which symbolise these groups of Experience are also ultimates of their kind; so also are the general relations which they present. We cannot reduce a sensation of Colour to a sensation of Heat or Sound, nor the conception of Matter to the conception of Force, the conception of Quality to that of Quantity, or that of Time to that of Space. These are ultimates; we cannot get beyond them to see their derivation. If the idle metempirical question arises, What lies beyond the conditions of a sensation of colour or a conception of quantity? we can only answer, The whole universe lies beyond it; and you may then ask, What beyond the universe? and so on in interminable questions, the inanity of which is manifest in this, that could the questions be answered, they would in no sense affect our dealings with the facts before us; we should know absolutely nothing more of colour or of quantity by knowing what preceded them, or existed beyond their conditions of existence. If we unite all sensations under some general group of Feeling, according to the unifying tendency of Speculation, and all qualities under some general group of the Felt, and all law under one law, this must not lead us to overlook the fact that such unities are abstractions, and are to be treated as such.

70. Now it is very noticeable that the mind is prone

to deal with abstractions in strange disregard of the concretes they express; so that men who candidly admit their inability to explain some of the elementary vital processes, profess to have a theory of Life, and unable to explain the cardinal facts and laws of light, heat, electricity, &c., are confident in their assertions respecting the Cosmos, its origin and purpose. No wonder, then, that, instead of laboriously ascertaining what is known of the *properties* of Matter, they imagine that they can by a facile exercise of divination detect the *nature* of Matter. Instead of classifying the observed phenomena, they classify their conceptions without verifying them, without ascertaining in how far these conceptions represent actual experiences. It is obvious that a perfect theory of Matter must embrace and explain all material phenomena; and it is equally obvious that this cannot be done unless all the phenomena are inductively established and classified.*

71. Let us, by way of illustration, consider what progress would have been effected in electrical science, if, instead of observing, analysing, and classifying the facts, men had continued for centuries speculating about what Electricity was in itself,—what its hidden nature was? Since a special group of material phenomena could not thus have been brought within our

* In the words of Sir W. THOMSON, "Every addition to knowledge of the properties of matter supplies the naturalist with new instrumental means for discovering and interpreting the phenomena of nature, which in their turn afford foundations for fresh generalisations, bringing gains of permanent value into the great storehouse of philosophy." This is not apparently the opinion of metaphysicians; it is, at any rate, not their practice, for the "People's Friend" MARAT could say with justice, "Les philosophes sans règles, sans principes, au lieu d'examiner ce qu'ils voulaient connoître, *définirent tout d'un coup ce qu'ils ne connassaient pas.*"—*De l'Homme, ou des Principes et des Loix de l'Influence de l'Âme sur le Corps.* Amsterdam, 1775. Pref. p. iv.

grasp still less could the universal group, if philosophers had continued deducing conclusions from unverified conceptions, instead of observing and registering all our experiences, and ascending to generalised Notations of these, which in turn served as bases for speculative generalisations to be subsequently verified, so that, from this mass of observation and inference hypotheses might be formed respecting the extra-sensible conditions. Our only progress has been effected by an extension of known properties and known laws, under the guidance of new inferences, and their verification. The Method has been that of a constant extension of the sensible into the extra-sensible, and a subsequent reduction of inference to Feeling or Intuition. Hypothesis and Deduction have been largely employed; but it is a fatal error to suppose that Deduction, even the most plausible, can, unaided, extend positive knowledge; while the deductions of metaphysicians have, for the most part, been without an inductive basis. I have already pointed out the fallacy of pure Deduction being competent to reach truth *à priori* (PROBLEM III. § 69), but the importance of the topic makes me recur to it here in presence of the metaphysical discussions respecting Matter.

72. The triumphs of Deduction are seen in the mathematical treatment of Physics, where equations of the same form are found applicable to very dissimilar groups of phenomena, such, for example, as Heat and Electricity: that is to say, the relation between the cause and the effect is expressed by equations of the same kind, so that when a problem is once solved in one group, the solution is translated into the terms

of the other. Thus is established the congruity of symbols, which is the aim of science. But this is possible only so far as the relations formulated are sufficiently general to be theoretically identical: no sooner are other and heterogeneous relations introduced under the symbols, than the deduction becomes vitiated. For instance, "Potential, in electrical science, has the same relation to Electricity that Pressure in Hydrostatics has to Fluid, or that Temperature in Thermodynamics has to Heat. Electricity, Fluids, and Heat all tend to pass from one place to another, if the Potential, Pressure, or Temperature is greater in the first place than in the second. A fluid is certainly a substance, heat is as certainly not a substance; so that though we may find assistance from analogies of this kind in forming clear ideas of formal electrical relations, we *must be careful not to let the one or the other analogy suggest to us that electricity is either a substance like water, or a state of agitation like heat.*" * Nay more, we must be careful not to conclude that even the phenomena of conduction will be in all respects the same in their results, since experiment may disclose striking diversities. Thus if a conducting body be suspended within a closed conducting vessel, and the vessel be charged with electricity, the body will show no signs of electrification either when within the vessel or on being removed from it; whereas the body included in a vessel which is heated will become of the same temperature as the vessel, and will on being removed retain this heat for some time. So indispensable is Verification even when the deductions seem most guaranteed.

* Clerk Maxwell: *Electricity and Magnetism*, 1873, i. 74.

73. In the preceding chapter we have been dealing with sensibles, with Matter as it is given in Feeling; and although we have from time to time found ourselves compelled to pass beyond the sensible limit, compelled to interpret sensible perceptions by ideal conceptions, still our main purpose has been the classification and elucidation of the observed phenomena. We have now to pass the limit of Observation, and enter on that of Speculation. We quit the record of Feeling, and inquire into the nature of the Extra-sensible. This inquiry may also be strictly scientific, closely as it borders on the region of Metempirics. We shall no longer be dealing directly with the facts of Feeling, but explaining them by indirect inferences and constructions.

74. The theory of gases perfected by Clausius and Maxwell is an example of this mode of interpreting sensibles by extra-sensibles. The molecules of all bodies are postulated to be in a state of constant oscillation. In solids, each molecule never passes beyond a certain distance from its original position. In fluids, the molecule, after moving from its original position, is capable of moving still further onwards, instead of moving back again. In gases, the molecules are flying about in all directions, frequently coming into collision and rebounding; and it is on these mutual impacts that the slowness of diffusion among gases depends. To the ordinary dynamical conceptions drawn from masses and applied to molecules, other conceptions were needed in addition; and Sir W. Thomson claims for the "deeply-penetrating genius of Maxwell" this addition of "viscosity and thermal conductivity, which thus completed the explanation of all the known properties of gases."

75. To investigate extra-sensible Matter on the scientific Method is to eliminate all metempirical conceptions, and proceed wholly along the lines of Experience. We are not only justified in assuming what is known of masses to be true of molecules (within certain limits), but we are compelled to do so; and if in our tentative efforts we for the nonce assume any size, form, or velocity of molecules, not incompatible with sensible experiences, we are also justified; the only provisos being—1°, that such assumptions shall prove their value by the aid they bring in explanation of the observed facts; and 2°, that we shall not regard these assumptions as true before they have been verified to be the equivalents of the experiments. The problem of Extra-sensible Matter may thus be stated to be *the determination of those extra-sensible conditions which enable us to interpret sensible phenomena.* The rapid advance of Molecular Physics in these later days assures us that a solution of this problem is at hand. The bases are already laid. Thomson, Loschmidt, and Stoney have approximately determined the size of the atom (or let us say *particle*), by determining the superior limit to the number of atoms (particles) in a definite space. Stokes has determined the chronometric vibration of the atom. Clausius has determined the relative motions of atoms—the relation between their diameters and the mean length of their paths from impact to impact. And one great result of these discoveries has been, not only to reduce the chaos of extra-sensible speculation to the orderliness of sensible classification, but to settle the old metaphysical antinomy respecting infinite divisibility, since the extra-sensible particle is shown to be a de-

finite measurable bit of sensible matter, having the properties of matter,—so that the mass is but the sum of its units.

76. The reader sees that the true answer to the rational question, What is Matter? can only be an expression of the classified experiences of the Felt; and these experiences may be real or ideal, concrete facts of Feeling, or abstract and analytical interpretations of the sensibles by extra-sensibles. We logically separate the Felt from the Feelings; and in the Felt distinguish one group as Matter, another as Force. Both, however, are indissoluble in Feeling and in the Felt = and the conceptions by which we symbolise these feelings, like the extra-sensibles by which we extend the sensibles, are only artifices of interpretation, and only valid in so far as they are rigorously equivalent with actual feelings. Every conception which wants this equivalence, and which does not stand for actual experience, is to be rejected; and every conception which, although framed out of sensible experiences, is not proved to represent their actual order, is to be admitted only provisionally, till the equivalence be demonstrated.

ATOMISM AND DYNAMISM.

77. This much premised, we proceed now to consider the speculative views which have obtained currency. Two great systems embrace all minor systems: Atomism and Dynamism. The one regards Matter as constituted by infinitesimal units of constant values, with interspaces of variable values; these interspaces are supposed by one school to be filled with a peculiar medium, also constituted by units and interspaces; by

another to be pure Space. The Dynamist theory regards Matter as constituted by unextended centres of Force.

78. On both sides are ranged men of equal eminence. It is not for us to venture on a decision between them; all that we dare venture on is a general remark or two for the reader's meditation. First, we remark that the purely speculative, hypothetic nature of these systems should never be lost sight of. Philosophers familiarise their minds with a symbol, and easily forget that it is only a symbol, that it represents what they have inferred, but never felt. Thus the atom, for them, comes to assume the place of a real; not only of a real, but of one which is to explain the whole mystery of things, the *σπέρμα τῆς τοῦ παντὸς γενεσέως*. Yet Hegel, in treating of Democritus, the great founder of Atomism, pointed out that the atom is not a sensible, but an ideal; "it belongs wholly to Thought, even when we say that atoms exist." And he sarcastically refers to the analogous mistake of some moderns who hope by the aid of the microscope to get at the soul behind the organism, to see it and feel it there.* The atom is by many physicists and chemists held to be an indispensable conception. Perhaps so; only let us not suppose that it is, or could be, a *perception*. The reasonings of physicists may be greatly in need of such an artifice. We may accept the aid without taking it as proving the reality of the atom. The aid may be indispensable in the present state of science; it is, however, only an artifice, by which we introduce congruity into our symbols, and bring a variety of phenomena under one set of quantitative dynamic

* HEGEL: *Geschichte der Philos.*, i. 370.

symbols.* The utility of such hypotheses is not affected by any scepticism as to the reality of atoms. The question is, Are our calculations aided by them, and aided more effectually than by any others? In employing the Infinitesimal Calculus, no one ought to be troubled by doubts respecting the reality of Infinitesimals.

79. Again, their character as extra-sensibles, keeping on the lines of the sensible, must be distinguished from their character as fictions, having only a hypothetic value. That is to say, sensible experience tells us of masses divisible into smaller and smaller parts; and this experience, prolonged into the extra-sensible region, gives us the physical *molecule* and the mathematical *particle*, which is not conceived as without parts, but as having parts so small that they may be neglected. It is customary to apply the term molecule to compounds, and the term atoms to the constituents of these molecules; but very often atom and molecule are used interchangeably to express the smallest possible particle of a substance. Now so long as this extra-sensible is kept on the lines of the sensible, and no properties are assigned to the molecule or atom

* An illustration will explain what is meant by congruity of symbols. There is no natural connection between a number and a length; they are two independent kinds of magnitude, and yet their reduction to the common symbols of Algebra, which was the splendid achievement of DESCARTES, has not only given vast extension both to Geometry and Algebra, but also has enormously aided Physics. It is by no virtue in numbers that strings of similar thickness and tension, when their lengths are as 1, $\frac{2}{3}$, and $\frac{1}{2}$, produce a certain note, its fifth and its octave; but the fact having been observed that the musical progression has the same ratio as the numerical progression, the one may be taken as the *function* of the other, and the numerical relations being easily calculable, this part of Music is brought within the domain of Mathematics. The hope of science at the present day is to express all phenomena in symbols of Dynamics.

which do not belong to small masses, any explanation deduced from the mechanical actions of such atoms—such, for example, as the modern theory of gases (§ 74)—is to be reckoned part and parcel of positive knowledge, on the same ground that the explanations of astronomical phenomena are so reckoned. We are still within the region of empirical science in deducing the phenomena of the interference of light, as in deducing the phenomena of the tides, or the flow of waves in a canal. The magnitude of the moving bodies makes no difference in the laws of motion.

80. Observe, however, that all such explanations are simply quantitative, and do not tell us more of the *ultimate* nature of Matter than we already knew in knowing the masses. Since the atoms are only the masses "writ small," we may call this Quantitative Atomism, to distinguish it from Qualitative Atomism, which assigns other qualities to the atoms than those known to belong to masses—qualities which are not feelings, but purely speculative fictions, invented to assist calculation, and justified in proportion to the assistance they furnish. Of these, the ring vortices of Helmholtz and Thomson (§ 82) may be taken as a good example; but all the hypotheses of atoms with hooks,—with special movements,—with polyhedral forms, &c., belong to this class, and are contrasted with the hypotheses of atoms having definite weights, or of atoms having chronometric vibrations, which are the logical equivalents of the experiments, and are not fictions meant to supplement observation.

81. Qualitative Atomism leads easily into Dynamism, which merges all the characters of Matter in Force, and hopes thereby to get rid of the difficulty. "Dans

l'opinion de M. Ampère," says Cauchy, "les dimensions des atomes dans lesquels résident les centres d'action moléculaires, ne doivent pas être considérées seulement comme très petites relativement aux distances qui les séparent, mais comme rigoureusement nulles. En d'autres termes, ces atomes, qui sont les véritables êtres simples dont la matière se composent n'ont pas d'étendue." The radical objection to such a conception (unless taken for a mathematical fiction) is that it evades the fundamental fact in our sensible experience, and endeavours to explain what is given in Feeling by eliminating one of the co-operant factors. It presents us with an action which has no agent. This is not the case with other forms of Qualitative Atomism, which, although giving free play to imagination in constructing hypotheses respecting the qualities of atoms, does so with a view of reducing the observed facts to combinations of other observed facts, so that the hypothetic quality, although imagined for the purpose of explanation, is nevertheless a quality known to be manifested by some forms of matter, and therefore possibly by the atoms; and the only remaining operation is to show that the hypothesis does explain the observed facts as its consequences.

82. My meaning will be best illustrated by the hypothesis of ring-vortices started by Thomson from the discovery of Helmholtz of what occurs in the motions of fluids.* This interprets the properties of mole-

* The celebrated memoir by HELMHOLTZ, *On Integrals of the Hydrodynamical Equations which express Vortex Motion* (*Crelle's Journal*, 1858), was translated by Professor TAIT in the *Philosophical Magazine*, 1867, No. 226. In the same periodical for July appeared Sir W. THOMSON's paper *On Vortex Atoms*, suggesting that the ring vortices are the only true atoms necessary to account for the unalterable distinguish-

cules as due to ring-vortices in an uniform, frictionless, incompressible fluid. If we disregard the arbitrariness of this assumption, and grant the ideal fluid, in spite of its departure from all we know of real fluids, an assumption which may take its place beside the analogous assumptions of Dynamics, always at variance with concrete experiences (where no perfectly rigid or perfectly elastic bodies, nor uniform rectilinear motions present themselves), we may follow Helmholtz as he mathematically shows that *if* a whirling ring be once generated in such a perfect fluid, it will go on for ever, always consisting of the same portion of the fluid first set going; and because its elasticity causes it to rebound when touched, it could never be divided nor destroyed. It has thus at first and for ever the fundamental properties of individuality (being *this* ring and no other) and invariant quantity. Here then we have the indestructibility of matter, and the indivisibility of atoms. We have more. One of the fundamental dynamic properties of matter is, that it is recipient of momentum and energy; and these are due to its elasticity. A multiplicity of such ring-vortices would form endless varieties of combination, the connection of knotted self-involutions, whence corresponding properties.* Thus, the Agent and Action,

ing qualities of different kinds of matter. Compare with this the *Theory of Molecular Vortices* proposed by Professor CLERK MAXWELL in the *Philosophical Magazine*, 1861, 2.

* "It is to be remarked that two ring-atoms linked together, or one knotted in any manner with its ends meeting, constitute a system which, however it may be altered in shape, can never deviate from its own peculiarity of multiple continuity, it being impossible for the matter in any line of vortex motion to go through the line of any other matter in such motion, or any other part of its own line. In fact, a closed line of vortex core is literally indivisible by any action resulting from vortex motion."—Sir W. THOMSON, *loc. cit.*, p. 17.

Matter and Motion, given in our First Notion, is expanded into the theoretic Conception of Elements and Relations. When once a vortex is started, its properties are determined by the original impulse. We have no need of a Mythology of independent Forces; the combinations of the elements bring with them different relations, *i. e.*, varieties in objects and forces.

This hypothesis calls in imagined but not *unknown* factors; the dynamic properties of a ring-vortex are conceptions drawn from sensible perceptions. We know from spectroscopic investigations the important fact that a molecule can be thrown into a state of internal vibration, in which it radiates light of definite refrangibility—*i.e.*, of definite wave-length and period of vibration. We know, for example, that every atom of hydrogen has one and the same system of vibrations, and that even when this hydrogen is in the sun and stars, its atoms vibrate in unison with those on our planet, like two tuning-forks at concert pitch. This absolute equality in quantities observed in regions so distant and so different reveals an uniformity in elementary conditions which may be taken as a striking exemplification of the Law of Invariants. Although therefore the hypothesis may never pass beyond the hypothetical sphere, it is one which, expressing real experiences, does in a symbolical way express reality; and the only question is how much of the actual relations are symbolised in these conceptions?

83. When it is said that the hypothesis expresses real experiences in an abstract form, the meaning is, that whatever may be the actual factors, these relations are the equivalents of the mathematical forms symbol-

ised. For example, whatever may be the real factors in the phenomena of light, we are quite sure that there is something going on at each point of space, which is in the nature of a "directed quantity," the direction of which is normal to the direction of the ray; and this, or its equivalent, is demonstrated by what is called the phenomenon of interference.

The mathematician is perfectly aware that he is only translating the observed phenomena into abstractions, when, disregarding all the complexities of sensibles, he condenses certain relations into symbols, and declares that all bodies are the assemblages of *material points*, united together in different manners in different kinds of bodies; and warns us that he intends only to consider these points under their relation of points of application of forces.* That is his artifice; he does not mean it for an answer to the speculative question respecting the nature of matter. The chemist likewise understands his units of weight to be the material points of the combining substances, which, for the facility of the mental picture, he represents as atoms. It is the measurement of quantities with which he is concerned, not the determination of unquantified qualities.†

84. The subjective nature of the atomic hypothesis has been well marked by Auguste Comte, who says that "the intimate structure of substances must necessarily

* Poisson: *Traité de Mécanique*, i. 3.

† "While there can be no doubt that *physical* research points to a molecular constitution of matter, it is perfectly indifferent to the *chemist* whether his symbols represent atoms or units; and graphic formulæ would be as useful as they now are were it conclusively proved that matter is continuous."—Dr Crum Brown in *Philosophical Magazine*, 1867, vol. xxxiv. p. 129.

remain unknown to us" [a position I should only accept if translated thus: "What is hidden from Sense is not sensibly appreciable"]. "But," he adds, "in studying their properties, we are rationally authorised in introducing every hypothesis that may facilitate our inquiry, provided that these artifices are always conformable with the nature of the corresponding phenomena. The atomic hypothesis is of this kind. By attributing to the smallest conceivable particles all the general properties of matter, this unalterable seat best represents to us the essential fixity of the various fundamental attributes, which never present other differences than those of degrees." * And in his last work he places this conception of atoms on a level with that of Infinitesimals, considering the two to be historically affiliated.†

85. The distinction between the Atomic Theory and the Hypothesis of Atomism points to the distinction, noted just now, between the conception of atoms as extra-sensibles, and the conception of them as convenient fictions. There are stout upholders of the Atomic Theory who reject the hypothesis of Atoms. Their theory is simply the expression of the quantitative laws observed in chemical combinations, namely, the law of definite proportions, the law of multiple proportions, and the law of molecular weights. These laws are classifications of sensible facts; by extension to

* COMTE: *Politique Positive*, i. 520.

† *Synthèse Subjective*, p. 421. "This assimilation," says Mr MILL, "throws a flood of light on both conceptions; on the physical one still more than the mathematical."—*Auguste Comte and Positivism*, 1865, p. 194. The suggestion was probably derived from LAGRANGE (for whom COMTE always expresses the profoundest admiration). See the passage p. 80 of the *Mécanique Analytique*, ed. 1811.

extra-sensibles, what is true of masses is affirmed of atoms. It is found that nitrous oxide, for instance, contains in every 44 parts 28 parts of nitrogen and 16 of oxygen, that is *one* mode of measurement; *another* mode is to consider each molecule of nitrous oxide composed of 2 atoms of nitrogen and 1 atom of oxygen. When I am considering the weight of a body, and desire to measure that weight, I must do this by comparing it with some standard. If I find that it equals the weight of some other body which, according to a fixed standard, is called a pound, then I know that this mass of a pound is ideally divisible into smaller masses of ounces and grains, and these ounces and grains are in turn ideally subdivisible, the ideal limits being atoms.*

86. It is of the last importance to bear in mind that Atomism is an artifice of analytical expression, analogous to that of the Differential Calculus, which expresses sensible facts in terms of extra-sensibles, and is wholly indifferent to the objective existence of atoms. *The* atom, objectively considered as an *isolated* element, is a fiction: it is without *properties* since it is without *relations*. It has no extension, solidity, colour, &c., since these are reactions of Sensibility. How then can we conceive masses to be constituted by groups of such nonentities? Only by such a mathematical fiction as reduces surfaces to lines, and lines

* Hence POISSON concludes their reality: "On est conduit nécessairement à l'idée des infiniments petits lorsque l'on considère les variations successives d'une grandeur soumise à la loi de continuité .... les infiniments petits ont donc une existence réelle (?) et ne sont pas seulement un moyen d'investigation imaginé par les géomètres."—*Mécanique*, i. 14. But has not the great geometer here confounded reals with ideals?

to points, having neither length nor breadth; or reduces continuously-varying movements to movements that are supposed uniform for an infinitesimal time. Under this aspect atoms may be admitted, without our thereby accepting them as *τὰ ὄντα*, the ultimates of Existence; without our sharing either the exultations or the terrors which so many minds feel at the prospect of thus clearing away the mystery from the great problem of Existence.

87. Strange misconception this of seeking a final truth in atoms, as if they held the keys of the mystery! Not a final truth, not even a superficial truth, can be found in them, apart from the sensible facts which they artificially represent; they want the first condition of reality, that of being sensibles. They are symbols which enable us to connect various classes of observations; their utility is their congruity with other symbols. The theoretic importance of such congruity is immense; but we must never forget the true relation of Theory to Life. What a page of algebraic figures is to the splendour and variety of Light, with infinite gradations of blended colours, that is the theoretic arrangement of symbolical conceptions to the fulness and reality of Life. The scholar, poring over learned pages, animates their dead symbols with his living knowledge, interprets their signs by what he has *felt*,—and when he turns his gaze from books to Nature, he is bewildered by the crowding forms, his eyes, after having dwelt on mere shadows, are dazed by the luminousness of reals. The formulas promised wisdom; and have kept their promise so ill, that instead of unfolding to him the secrets of the universe, they leave him puzzled and irresolute in presence of

the simplest event. He then learns that formulas, theories, systems, in so far as they are intelligible to him, only give his feelings names, or teach him how to recognise the labels other men have affixed to things. However great the value of these names, it is he who must bring the knowledge of things which will give the names significance. Nature speaks to all men, but separately to each; what each hears, he sets down in shorthand notes, which he compares with the notes of others; and out of the multitude of comparisons, one correcting and supplementing the other, a more or less connected narrative is constructed. But this narrative, were it wholly without gaps and contradictions, could only be intelligible to the minds which interpreted the symbols into feelings,—in which the words reproduced experiences of things.

88. An abiding sense of the insufficiency of Atomism has forced some thinkers to adopt the equally insufficient hypothesis of Dynamism. Missing the recognition of a fundamental condition of reality, they have sought for this in Force, and centres of Force: here they believe lies the mystery of Matter. But they are compelled in denying Matter to materialise Force, and their centres are only the atoms viewed dynamically.

On this point let us consider Faraday's celebrated speculation: "I feel great difficulty in the conception of atoms of matter which in solids, liquids, and vapours are supposed to be more or less apart from each other in the intervening space not occupied by atoms, and perceive great contradictions in the conclusions which flow from such a view. If we must assume at all, then the safest course is to assume as little

as possible, and in that respect the atoms of Boscovich appear to me to have a great advantage over the more usual notion. His atoms, if I understand aright, are *mere centres of force or powers, not particles of matter in which the powers themselves reside.* If, in the ordinary view of atoms we call the particle of matter away from the powers *a*, and the system of powers or forces in and around it *m*, then in Boscovich's theory *a* disappears, or is a mere mathematical point, whilst in the usual notion it is a little unchangeable impenetrable piece of matter, and *m* is an atmosphere of force grouped around it." [If we banish the idea of an essential dualism, Matter *and* Force, replacing it by the dual aspect, statical and dynamical, in which *a* stands for Matter abstracted from action, and *m* for Force, *i.e.*, Matter *in action*, then the disappearance of *a* is simply the substitution of *m*—that is, it is *a* under the new aspect.]

"All our perception," Faraday continues, "and knowledge of the atom, and even our fancy, is limited to ideas of its powers." This proposition may be reversed, and we may be said to have no knowledge of its powers except as modes of existence of the atom. "A mind just entering on the subject may consider it difficult to think of the powers of matter independent of a separate something to be called *matter*; but it is certainly far more difficult, and indeed impossible, to think of or imagine that *matter* independent of the powers. Now the powers we know and recognise in every phenomenon of the creation, the abstract matter in none; why then assume the existence of that of which we are ignorant, which we cannot conceive [Faraday means cannot *imagine*], and for which there

is no philosophical necessity." According to the definition I have proposed, Matter, and the changes of Matter, mean the Felt, and the changes of the Felt; and all our knowledge of Matter is in Feeling, and the changes of Feeling. In this view it is perfectly justifiable to say that we know only the powers, and not the *abstract matter*, if knowledge means the concrete groups of feelings; but it is also true that if what we raise into an abstract conception is no more than what has been given in each separate perception, and the abstraction is only a generalised expression of the concretes, we know the abstract matter as we know all other abstracts. What we do not, and cannot know, is the abstract matter which is *more* than, or *other* than, the Felt and its changes: the substratum or noumenon of metaphysicians.*

Faraday seems to have been embarrassed by the contradictions which flow from the traditional dualism; and his speculation is an effort to disengage himself from it. Thus he says: "Before concluding these speculations, I will refer to a few of the important differences between the assumption of atoms, consisting merely of centres of force, like those of Boscovich, and that other assumption *of molecules of something specially material, having powers attracted to and around them.* With the latter atoms, a mass of matter consists of atoms and intervening space; with the former atoms, *matter is everywhere present, and there is no intervening space unoccupied by it.* In gases the atoms touch each other just as truly as in solids. In this respect the atoms of water touch each other, whether that substance be in the form of ice,

* On this point see Problem VI. chap. ii.

water, or steam; no mere intervening space is present. Doubtless the centres of force vary in their distance one from another, but that which is truly the matter of one atom touches the matter of its neighbour." If Matter be identified with Force, both as the aspects of Existence, this conclusion is rigorous, and the Cosmos is a *Plenum;* for since even on the ordinary supposition the atoms are assumed to *act* on each other, and since "action at a distance," on the ordinary supposition of an intervening void, is an untenable assumption (see Appendix C), the necessary conclusion is, that "matter fills all space, or at least all space to which gravitation extends (including the sun and its system); for gravitation is a property of matter dependent on a certain force, and it is this force which constitutes matter." There is ambiguity in saying Force constitutes Matter, and there is also ambiguity in the statement that "the smallest atom of matter on the earth acts directly on the smallest atom of matter on the sun, though they are 95,000,000 miles apart; further, atoms which to our knowledge are at least nineteen times that distance, are in a similar way *tied together by lines of force* extending from and belonging to each." If we admit the existence of atoms—indivisible points—and their action on each other, that action must be indirect, *i.e.*, propagated through the intervening medium, or the line which ties them together; and this is equally true when the distance between them is the infinitesimal distance of their limiting surfaces, or 95,000,000 miles. If, on the contrary, we get rid of the notion of the reality of atoms, viewing them only as fictitious centres, the "lines of force" being their radii, then indeed we have the conception of

continuity of Existence, a perfect Plenum, which for the sake of calculation is represented as an assemblage of atoms and interspaces, centres and lines of action.

89. But is the conception of a Plenum tenable? I think it the only conception consistent with experience, though I am not unaware of its difficulties. Whether there is, or is not, a real corresponding to our fiction of pure Space cannot be answered. Space as Extension we know, but Space as pure Nothingness cannot be known, since it cannot be felt; and whether it may be rationally inferred from what is felt, is a question not now answerable. We need the conception of Distance, and we have its correspondent perceptions; we need the conception of Room for movement, and we have the correspondent perceptions; but we do not need, I think, the further conception of pure space as a Void.*

After breaking up the continuity of Matter into discrete masses, the masses into molecules, and the molecules into atoms, as we break up continuous magnitudes into differentials and differentials of differentials, we have to restore continuity by the interposition of media. If one atom acts on another, or one mass on another, there must be a "line of force" connecting them, a "medium" between them. The aerial medium we know; that is a sensible, but it is finite, insufficient, and its insufficiency is supplied by an extra-sensible medium—the ether.

* It has been well said: "If we are justly surprised at the paradoxes in Hegel's Logic, in which the Nothing is equally real with Being, what shall we say to Empty Space, which is also a Nothing accepted as a real?"—HARMS: *Einleitung in die Physik* in *Karsten's Encyklopädie der Physik*, 1869, i. 315.

THE ETHER.

90. Three questions are agitated respecting it. Does it exist? Is it matter? Is it force? There are those who deny its existence, and those who attempt to deduce all phenomena from its condensations.* All depends on the point of view, and the meaning assigned to the symbol. While one class of thinkers regards the ether as a scientific artifice, another class not only regards it as a real, but measures its waves, and the amplitude of its oscillations, just as if they were sensible reals, like water-waves or air-waves. Need I say that these waves and oscillations are purely hypothetical, but that inasmuch as they enable us to introduce congruity among our symbols, they are valid hypotheses; and inasmuch as they stand all the tests of experiment, they *represent* corresponding reality? It does not follow that because mathematicians decompose a movement of the air into imaginary pendulum movements, therefore these pendulum movements really compose the movement.† Fourier's law is a mathematical law of immense value; but it is only an artifice of calculation; we have no warrant for concluding that except in special cases it is more than a symbolical representation of the facts.‡

91. A medium is indispensable, and the Ether is the materialisation of that medium. When we are

* "È cosa veramente singolare," says the padre SECCHI, "il vedere come mentre alcuni fisici cercano di ridurre tutto all' azione dell' etere, altri trattano questo agente come fosse un ente fantastico."—*L'Unità delle Forze Fisiche*, 1864, p. 149.

† HELMHOLTZ has indeed shown objective grounds for regarding these pendulum movements as real, but mathematicians did not wait for that proof, they were content with hypothetic movements.

‡ Comp. § 93.

asked whether it is material, and if so, whether it is "ordinary matter" in a rarefied state, we must insist on precision of the terms. It is not ordinary matter, if that mean iron, chalk, or gas; but in this sense albumen is not ordinary matter. It is not matter, if that mean masses, molecules, atoms, since those are specially distinguished from their medium; but if matter mean the Felt, the Agent of which the Activity is Force, then this medium, which is the continuity of masses, the lines along which the activity moves, is material. It is said to be different from ordinary matter, which is ponderable; and it is thus kept apart as the substratum of the Imponderables. Now there are excellent reasons why the Ether should not be ponderable. Weight is a *differential condition of Pressure*, and only obtains between bodies; whereas the Ether is not *a body*, but the medium in which all bodies are. Ordinary experience tells us that, to be weighed, a body must be in a medium lighter or heavier than itself; a bucketful of water can be weighed in the air, but in the water this same bucketful would not disturb the most delicate balance. Just as no drop of the ocean can be weighed in the ocean, so no volume of Ether can be weighed in the ether. But although not ponderable, the Ether is proved, by its effects, to exert pressure; and that it may possibly be measured in certain cases has been shown by Professor Clerk Maxwell,* who says that the propagation of waves

* "In a medium in which waves are propagated there is a pressure in the direction normal to the waves, and numerically equal to the energy in unit of volume. Thus if in strong sunlight the energy of the light which falls on one square foot is 83·4 foot-pounds per second, the mean energy in one cubic foot of sunlight is about 0·000000882 of a pound

produces a pressure in the direction of the ray, which he estimates to be equal on a square foot of surface to the whole energy of radiation in a cubic foot.

92. Respecting the third question, whether the Ether is Force, or Repulsive Force, I shall say nothing here. The reader may deal with it after he has accompanied me through the succeeding Problem. What I have specially to solicit attention to is that Ether is an extra-sensible hypothesis; and any theories which attempt to shift the problem of Matter, by quitting the domain of the sensible, and wandering *only* in that of the Extra-sensible, are self-condemned. If the extra-sensible hypotheses serve to give unity and systematic completeness to sensible experiences, that is all we can demand of them; they must never displace what they are intended to explain.

A good example of what I mean is to be had in the

weight. A flat body, exposed to sunlight, would experience this pressure on its illuminated side only, and would therefore be repelled from the side on which the light falls. It is probable that a much greater energy of radiation might be obtained by means of concentrated rays of the electric lamp. Such rays falling on a thin metallic disk, delicately suspended in a vacuum, might perhaps produce an observable mechanical effect."—CLERK MAXWELL: *Treatise on Electricity and Magnetism*, ii. 391.

M. GAUDIN also says: "Bien que l'éther soit dit *impondérable*, faute de pouvoir en priver l'espace, il est matériel au plus haut degré. Pour un espace donné il représente bien plus de matière que les atomes chimiques; et, de plus, les atomes chimiques, tout à fait inertes par eux mêmes ne prennent du mouvement que par son impulsion, ce qui nous amène à dire que les mouvements d'un atome chimique sur notre terre sont la résultante mathématique de toutes les ondulations éthérées que lui arrivent avec le temps des abîmes de l'espace infini. La pression de l'éther est prodigieuse, comme la prouve, du reste, la mesure de son élasticité, dont la vitesse de propagation de la lumière n'est qu'un indice."—*L'Architecture du Monde des Atomes*, 1873, p. 5.

Compare also HERSCHEL: *Familiar Lectures on Science*, p. 282; and BIRKS: *Matter and Ether*, 1862, p. 14.

Molecular Theory of Vortices propounded by Professor Clerk Maxwell, who with profound scientific insight warns his readers not to suppose the imaginary mechanism conceived by him is a reproduction of what exists in nature, or what he himself would willingly accept as an electrical hypothesis. "It is, however, a mode of connection which is mechanically conceivable and easily investigated, and it serves to bring out the actual mechanical connections between the known electro-magnetic phenomena; so that I venture to say that any one who understands the provisional and temporary character of this hypothesis will find himself rather helped by it in his search after the true phenomena." *

93. The warning was needed. So great is the tendency of men to accept a suggested image for a verified induction, an hypothesis for a fact, that at times we are led to wish that no hypothesis should be expressed in images, but only in mathematical symbols. Even philosophers are too apt to credit an hypothesis as the expression of Nature, when calculations founded on it are shown to be in conformity with experiment. But this conformity is not a final test of the reality. What is proved by it is the utility of the artificial aid, not the reality of the conception. The hypothesis of "action at a distance" is strikingly conformable with observations of electrical phenomena; but equal conformity is obtained on the contrary hypothesis of action propagated through a medium. Both hypotheses cannot express the truth. The hypothesis of an imponderable fluid—Caloric—was the basis of mathematical expression of the laws of radiation,

* *Philosophical Magazine*, May 1861, p. 346.

conduction, transmission, refraction, and polarisation; it has since been replaced by the hypothesis of molecular vibrations.

Science has two distinct procedures: 1°, The investigation and classification of relations, condensing them into Laws; 2°, the mathematical investigation of the relations of such relations, the *reason* of such Laws. The one is real, the other ideal. A Law is a formula of the facts. A Theory is a formula of the reasons of those facts. An Hypothesis is a postulate which helps Theory where Observation halts.

94. It is unnecessary here to enter upon the many points of interest connected with the hypothesis of an Ether. I have indicated its nature as an hypothesis, and may say, in conclusion, both of it and of Atomism, that if we cease to regard them in the light of some deeper reality than is given in sensible experience, and cease to seek in them for a solution of the mystery of Matter, they may greatly aid us in extending our knowledge of Matter, since they connect and classify observations of widely-separated phenomena. But we must always understand that atoms and ether are ideal constructions. Their value, and the limits of their application, are ideal, and as such may be compared with the great achievements of Newton and Ampère in explaining the rotatory motions *observed* in planets and magnets as the consequence of forces acting in the straight line between the points. It is obvious that this rectilinear action is hypothetical. It is certain that the real motion is that of a rotation of the bodies, as nothing else is observed nor observable. The geometric construction is purely ideal; the observed rotations are explained on the assumption of

a force acting according to the law of inverse squares, another ideal; this radius vector passing over equal areas in equal times was never seen by mortal eye. All we know is, that *if* there were a radius vector, it would describe equal areas in equal times; and that *if* there were an attractive force acting along the straight line between the points, it would be represented by such a law. In like manner we may say, *if* masses are composed of atoms, and *if* there is an ethereal medium between them, the mathematical explanations of observed facts which are based on such assumptions are exact; but we can never know whether the assumptions themselves have any correspondent reals. The Matter we know, is the Matter we feel.

CHAPTER V.

THE SOLUTION.

95. We have now before us, if not the final solution of a problem, which can never finally be solved so long as Experience is progressive, at least a "first approximation." Having eliminated the metempirical aspects of the question, there only remain the facts of Experience to enumerate and classify, and the question is answered. Those lofty minds who despise the poor results of a science which can only classify feelings, and the symbols of feelings, will, of course, be scornful of this meagre answer. Their question is, What is Matter *apart* from Feeling? and our answer does not touch that. We, who maintain that all knowledge whatever is only virtual Feeling, and can never pass beyond the range of Feeling, are necessarily concerned with Matter only as the Felt.

If any one asks, What is Virtue? what is Wealth? or any other abstraction, he is satisfied when all the concrete facts are specified which the abstraction condenses in a symbol. In like manner we must be satisfied when the abstraction Matter is defined, and its concretes specified. We define it as the statical aspect of Existence—it is whatever is, when considered as *capable* of acting, as Agent; the dyna-

mical aspect of it being Force or Activity. This is the purely objective view, in which it is isolated from Feeling. On the objective view it is the Felt. If we say Matter is the generalised expression for all things felt, the objective element in sensibles, and is logically distinguishable from Force, which is the generalised expression of all things felt in their changes, we have defined all that Experience warrants.

96. Descending to an enumeration of all the particulars included in this general definition, we specify the concrete facts of Experience, describe and classify according to their ascending degrees of complexity and dependence the various Properties and Laws disclosed by observation. Our comprehension of Matter widens with widening experiences; with more and more differentiations of Feeling arise more and more qualities in the Felt; with more and more connections among feelings arise more and more relations in the Felt; and Knowledge advances by a continuous double process of discernment of differences and classification of likenesses. Not only the positive experiences of sensibles, but the speculative inferences of extra-sensibles are grouped into a system; and thus Matter presents the twofold aspect of the Real and the Intelligible, the Felt and the Thought.

97. This task of specifying and classifying the concretes of Experience is the purpose of Science; and Metaphysics, accepting the generalised results thus reached in the several departments of research, co-ordinates them into a system. That the metaphysical system will vary with the varying materials furnished it by Science, is inevitable; and since we cannot imagine a limit to the progressive discovery of more

and more objective relations, we must be content with solutions that are but approximations. The general question, What is Matter? is answered once for all when we define Matter, the Passive Aspect of Existence. The particular questions respecting the Properties of Matter, and their mutual dependence, can only be answered by confining them to the Properties known at the time; and we must always be prepared for fresh extensions of knowledge, as more and more of the illimitable Unknown is brought within the range of Experience.

98. If any reader is dissatisfied with this solution of the problem, let him consider whether a final solution is possible in any other case. The geometer defines his circle, and enumerates its known properties; does he suppose that there are no undiscovered properties, over which at present he is without control? Or does he feel dissatisfied with what is known, because of the unknown? Are his geometric truths uncertain, because other truths may dawn on future mathematicians? Why, then, should the physicist be dissatisfied? He has defined the known Matter, and enumerated the known properties; he has affixed definite symbols to groups of experiences, and can operate on those symbols with the certainty of their being the rational equivalents of experiences. More than this he does not need. More than this he should not ask.

PROBLEM V.

FORCE AND CAUSE.

"He that shall discourse weightily on Efficient Causes, setting forth in clear conceits the nature thereof, maketh philosophy his servant. 'Tis a noble quest, but we have wandered from the ways."

SIR THOMAS BROWNE.

"The problem of the sciences is in the first place to seek the laws by which the particular processes of nature may be referred to and deduced from general rules. These are evidently nothing more than general ideas by which the various phenomena are connected together. The finding of these is the office of experimental science. The theoretic position seeks, on the contrary, to evolve the unknown causes of the processes from the visible actions which they present; it seeks to comprehend these processes according to the laws of causality. We proceed until we at length arrive at ultimate causes which are unchangeable, and which must, therefore, in all cases where the conditions are the same, produce the same invariable effects."

HELMHOLTZ.

FORCE AND CAUSE.

CHAPTER I.

THE CONCEPTION OF FORCE.

1. THE word Force is a symbol which has many meanings. It varies in different works, and often in different passages of the same work. Sometimes it stands for the Unknowable, whose manifestations are the objective universe; sometimes it is the common measure by which all phenomena are rendered intelligible; sometimes it is an imaginary entity supposed to take up its habitation in substances, passing freely from one to the other; sometimes a peculiar kind of Matter, very subtle, and endowed with qualities wholly unlike those of ordinary Matter; sometimes it is the simple synonym of cause, sometimes of strength, sometimes of motion; now confounded with, and now distinguished from Energy. A mathematician is contented with defining it "the differential co-efficient of the quantity of movement," and the formula $F = M \frac{dv}{dt}$ answers all his purposes. But the physicist has his cohesive, diffusive, elastic forces, the chemist has his affinity, the biologist his vital forces, and the

psychologist his moral forces—which are not so readily reducible to the mathematical formula.

If we consider what all these different meanings have in common, it will be found that the definition I have proposed—the Activity of Matter, or the Changes in the Felt—comprises them all. Every Agent, material or spiritual, may be viewed statically, capable of acting, or dynamically, in action; and when forces are said to *animate* Matter, they are supposed to give life and activity to what is in itself inert. Activity is the *Kraftbegriff*, or conception of Force, which is common to all European thinkers; but in England the leading physicists of our day have greatly restricted the meaning of the term Force, and introduced that of Energy to express much of what elsewhere is included under Force. There is certainly great need of precision, for we meet with such tautologies as dynamic-force, motive-force, and static-force —which are equivalent to force-force, motive-motion, and resting-motion.

2. Helmholtz has stated with precision the point of view I here adopt: "Science regards the phenomena of the external world by two processes of abstraction: in the first place it looks upon them as simple existences without reference to their action upon our organs of sense, or upon each other; in this aspect they are named *matter*. The existence of matter in itself is to us something passive and devoid of action: in it we distinguish merely the relations of space and of quantity (mass), which we assume to be eternally unchangeable. To matter thus regarded we must not ascribe qualitative differences, for when we speak of different kinds of matter, we refer to differences of

action, that is to differences in the *forces* of matter. Matter in itself can therefore partake of one change only —a change which has reference to space, that is motion." [In other words, the abstraction Passivity can only be correlated with the abstraction Activity.] Natural objects are not, however, passive; in fact, we come to a knowledge of their existence solely from their action upon our organs of sense, and infer from these actions a something which acts. When, therefore, we wish to make real application of our idea of matter, we can only do it by means of a second abstraction, and ascribe to it properties which in the first case were excluded from the idea, namely, the capability of producing effects, or in other words, of exerting force.

"It is evident that in the application of the ideas of matter and force to nature the two ideas should never be separated: a mass of pure matter would, as far as we and nature are concerned, be a nullity, inasmuch as no action could be wrought by it either on our organs of sense, or on the remaining portion of nature. A pure force would be something which must have a basis, and yet which has no basis, for the basis we name matter. It would be equally erroneous to define matter as something which has an actual existence, and force an idea which has no corresponding reality. Both, on the contrary, are abstractions from the actual, formed in precisely similar ways. Matter is only discernible by its forces, not by itself."*

3. The aim of Science is to express all phenomena in terms of Matter and Force, so that by these means

* HELMHOLTZ: *On the Conservation of Force*, translated in the *Scientific Memoirs* edited by TAYLOR and FRANCIS, 1853, Part II. p. 115 (slightly altered).

congruity may be introduced into the conceptions which systematise Experience. The phenomena are viewed alternately as causes and effects, as agents and actions. We generalise our manifold experiences, and generalise these generalities into wider generalities. Among these latter there are four of supreme importance: Matter, Force, Position, and Motion.* Although we distinguish these as symbols, they only represent different aspects of reality. It is only in abstraction that Force can be separated from Matter, or Motion from Position. The one reflects the other as a correlative. For Position there must be Matter posited, and for Motion there must be Matter in changing positions. Rest or Position is only Motion equilibrated. Force is mass-acceleration, or *directed pressure*, and as such is the cause of every change; it has also been defined "the measure of the tendency of Energy to transform itself from the negative condition of Position to the positive condition of Motion."

ENERGY.

4. And what is Energy, which is thus distinguished from Force? It is the symbol expressive of that indwelling capacity of doing work possessed by every agent—1°, in virtue of its position, when it has *potential* energy, and 2°, in virtue of its change of position, when it has *actual* or *kinetic* energy. Thomas Young first introduced the term energy to express the quantity of work a body is capable of doing; and the further distinction of this into potential and actual was made by Macquorn Rankine in 1853.† The potential energy

* See TAIT: *Thermodynamics*, 1868, § 3.

† See his remarks in *Philosophical Magazine*, January 1867, p. 89.

expressed those relations among bodies or parts of bodies which consist in a power of doing work dependent on mutual configuration; it is a quantity which is represented in the 39th proposition of the *Principia* by the area of a figure. Physicists now—in England, at least—refuse to apply the term Force to the phenomena of Energy; they confine it to that directed pressure of a mass which causes, or tends to cause, a change of motion. Nor indeed can the term be properly applied to such a quantity as that of potential energy, since the power of performing work is not simply force, but force multiplied by linear space. The force acting *between* two bodies is a function of their distance only. The word Power is also open to objection, being already used in Mechanics in three different senses, namely, the power of an engine (the rate at which it performs work), the pressure which drives the engine, and the "mechanical powers," *i.e.*, certain elementary machines. Sir W. Thomson having adopted Young's term to express capacity for doing work, Rankine wished to distinguish between this capacity *in action*, and this capacity *in position*. Thus potential energy meant what Carnot had called *force vive virtuelle*, and was distinguished from actual energy. This latter term is now replaced by *kinetic energy*, in the writings of Thomson, Tait, and their followers, who, adopting Ampère's designation of Kinematics for the whole science of Motion in the abstract, designate the science of Matter under Force by the term Dynamics (usually termed Mechanics), which they divide into Statics and Kinetics.

5. Hence we have three symbols—1°, Force, the abstract conception of Activity as Cause; 2°, Energy, the

specification of this Activity, as a measurable *horse-power quantity*, either actual or potential; 3°, Motion. The *motion* of a cannon-ball may be considered abstractly as the path it describes in its changing positions in space, without reference to its velocity or its mass. The *velocity* is the rate at which it moves through these positions. The *energy* is the quantity of resistance it is capable of overcoming, and is proportional to the mass of the cannon-ball and the square of its velocity, *kinetic* energy being half the *vis viva* or the product of the mass and half the square of its velocity. The *force* is that which is said to be expended in the production of energy; hence its definition—"that which generates velocity, and is measured by momentum"—since force is the rate of change of momentum expressed in terms of the position of other bodies. When force does not generate motion, it causes pressure, and is then measured by Resistance. Energy, which is force acting, does work in overcoming Resistance, which is force acted on and reacting; and work done is defined, "the space moved over against resistance," multiplied by that resistance, *i.e.*, the action of a force. When a stone falls from a height by the action of the force of gravity, it acquires more and more kinetic energy in approaching the earth, that is to say, its real power of doing work is increasing with each change of position; it is expending in the fall all that potential energy which had been expended in raising it to the height from which it falls; and this increase of kinetic energy is the increased action of gravity. When the stone is thrown upwards, the force of impulsion is acting against the force of gravity, and the kinetic energy with which the stone started is

gradually decreased till it ceases altogether; during the ascent it is gradually transformed into the potential energy of position, to be retransformed into actual energy as the stone returns to the earth. There is thus an incessant transformation of Energy into actual or potential, but no increase or decrease of its quantity.

6. This is the grand law of the Conservation of Energy, commonly called the Conservation of Force. Although by many English authorities this latter phrase is condemned, I cannot agree in the condemnation. Force being our symbol for the Activity of the Agent, whether the agent be a molecule, a mass, a mechanism, an organism, a tribe, or a nation, its activities, *insistant* or *resistant*, are its modes of existence; and although these modes will vary, their sum must be constant; the indestructibility of Matter involves the indestructibility of Force. For observe, it is only by viewing Energy as abstract capacity, disregarding the concrete fact, that the law of its conservation can be admitted. It is indubitable that there is a disappearance of energy, that is to say, of the actual working power, in every kilogrammetre of work done; the energy of heat is spent in tearing asunder the molecules, and *that* energy is now no longer *really* doing work, but only *ideally* conceived as a possibility of doing work when its present relations are replaced by the old relations. The same arguments which prove that Heat is not a substance, and that when it enters into a substance, becoming *latent*, to use the old phrase, it no longer exists there in the form of Heat, may be applied to show that the Energy which a body has when in motion no longer

exists as a capacity of doing work when it has ceased to move—that capacity is then only an ideal possibility. So with Force, which is expended in energy: which means that a directed quantity of *pressure* is converted into so much *horse-power*.

The English writers to whom I have referred limit Force to that which produces change of motion, and is measured by the change produced. They, therefore, deny that Motion, Heat, Light, or Electricity, are properly called forces. And if we compare these energies with the force of gravitation, the force of cohesion, or the force of chemical affinity, a distinction is evident. Two bodies tend to move towards each other, and this tendency is symbolised in the term attraction; when the restraining conditions are altered, the tendency becomes realised, the bodies move towards each other, and in this moving they acquire energy. The force of attraction is thus expended in, or specified in, the energy acquired. The force was not motion, but the abstract possibility of motion, and this abstract possibility is the condensed expression of the whole group of conditions—in other words, the cause.

7. The popular notion of Force as something which acts on Matter, and acts across space, is that of a rider seated in a chariot directing the horses, or of something lying hidden in bodies, and ready to leap out when the bodies are stimulated. It is in the former sense that the force of gravity is supposed to cause the fall of the moon towards the earth; it is in the latter sense that Electricity is supposed to manifest itself in two currents. The electrified body has certain properties which are transferred from the body

to the imaginary agent Electricity. Thus, suppose we have a vessel A charged with positive electricity, as we name a particular condition of the molecules, and suppose we suspend A inside a larger vessel B, which is insulated. Although A does not touch B, its presence causes B to be positively electrified on the outer surface. If we let A now come in contact with B, no change in the external electrification is observed; but if A is removed to a sufficient distance, we shall find that it has now lost all its electricity, and that B has gained this lost amount. We have here an example of transference of electrical force, which looks like the pouring of so much water from one vessel to another. But how is this appearance created? By the suppression in thought of the changing conditions of both vessels during the process—a suppression which is not possible in reality.

8. A watermill is used to raise an iron hammer. The fall of the water is the force as a *cause;* the rise of the hammer is the energy, which is measured by the work done against gravity in the height to which the hammer is raised. But it was the energy of the falling water which, striking on the wheel, caused the wheel to revolve; and the axle of the wheel having small projections, these, as it turned, lifted the hammer, and let it fall again. The height to which a hammer is lifted determines the energy with which it will fall again. The amount of pressure exerted by the water on the wheel is equal to the amount of resistance to be overcome in raising the hammer. To raise a hammer of ten pounds to a distance of one foot from the earth, there must be ten pounds of water falling on the wheel through a distance of one foot, or five

pounds through two feet. The energy of the water has passed into the energy of the hammer. We may call the *water-energy*, cause, or antecedent, and the *hammer-energy* simply effect—the identity of the two is not altered.

9. Newton saw in the fall of an apple a force which dragged not only the apple to the earth, but the moon, —a force which caused terrestrial and celestial falls. But Newton did not ask himself what force *raised* the apple to that height from which it fell. It is obvious that when the apple was hanging from the tree it had stored up within its relative position the energy which would be spent by it in any change of position; the energy with which it would strike the earth in falling was *potential* energy, which would become *actual* energy: what is *now* the possibility of motion, or energy of position, *will be* precisely the same amount of actual motion or kinetic energy. Since, therefore, there is an exact equivalence between the amount stored up and the amount expended, we see at once that, to store up this amount, there must previously have been an equivalent expended—the height *from* which the apple falls is the height *to* which that apple was raised. Now the apple assuredly did not raise itself. What raised it? This question, which few men would think of asking, and most men would answer with a vague generality, such as the "vital force of the tree," or "the Creator's fiat," modern Science has given us the means of answering; and the startling answer will take somewhat this form: The molecular agitation of a body many millions of miles distant throws the medium into undulations; and these, when they strike upon the tree with a per-

iodic recurrence of many millions in a second, cause a variety of molecular movements in the tree; and one result is, that molecule after molecule is carried upwards from the soil to the tip of the twig, whence the apple finally appears. In briefer language, the apple is carried up from the earth by the energy of the sunbeams: and all this energy expended in raising the myriad molecules will be restored when the apple falls.

FORCE AS PRESSURE.

10. The phrase "force expended" is common, and is misleading. The force, or dynamic attribute of a mass, cannot be expended, cannot even be transformed, but it can be *combined* with other forces, now in this way, now in that; and the products of such combinations will be various. The Law of Invariants, which is another form of the axiom of Indestructibility, declares that every unit of force is invariant, and every sum of units is constant, whether the result be the balance of tension or the excess of *vis viva*. The tension and *vis viva* may be compared with the pressure and the flow of a fluid. In a tank of water there is a certain amount of possible motion (force, therefore), which is the sum of the pressures: these pressures being everywhere equalised, the water is at rest. A stopcock is now turned; there is then an excess of pressure in this direction: the water flows, and its kinetic energy is this excess, this differential pressure.

11. The reader sees, of course, that in using the word *pressure*, we are simply employing a familiar term by which to render the abstract term more intelligible, by connecting it with our feeling of muscular effort.

This seems the readiest way of interpreting the objective aspect of Force into its subjective equivalent. We can translate the abstract Force into abstract Pressure, and any particular force into an excess of pressure in one direction.* If the symbol represents experiences, and is capable of being translated into perceptions, we must seek in Feeling, and the sequences of Feeling, for all that is expressed by Force. Now every perception of an existent involves a correlative resistant, and our conception of one body acting on another, determining a change in its position, is framed out of our primary feelings of the resistances we are able to overcome. We transfer our subjective expe-rience to the objective change, and see in the body acting, an effort; in the body acted on, a resistance. The effort we exert in moving a body corresponds with the pressure we exert; and this is measured by the counterpressure of the body—its resistance. This effort, which is a motor feeling in us, we translate into a mobile quality in the object. We call our action the action of Will. We do not call the action of bodies on each other by this name (Schopenhauer does), because Will connotes an Intelligence which we deny to them; but we call the action of bodies, and our own action, by the name of Force, and speak of our own as the force of Will.

* "De même que le produit de la masse et de la vîtesse exprime la force finie d'un corps en mouvement, ainsi le produit de la masse et de la force accelérative exprimera la force élémentaire ou naissante: et cette quantité si on la considère comme la mesure de l'effort que le corps peut faire en vertu de la vîtesse élémentaire qu'il a prise, ou qu'il tend à prendre, constitue ce qu'on nomme *pression;* mais si on la regarde comme la mesure de la force ou puissance nécessaire pour imprimer cette même vitesse, elle est alors ce qu'on nomme *force motrice.*" —LAGRANGE: *Mécanique Analytique*, p. 229.

12. Having no experience of a change effected on objects by us except such as is effected through the exertion of our muscles, we can only conceive change to be originated by a movement somewhere, which is a pressure in excess of the resistance. We are momently made aware that the mere idea of a change passing across our minds,—the mere wish for a change rising amid our desires,—will produce no change, no motion, unless accompanied by the requisite pressure from us. It is this pressure which realises the wish, and gives it objective form. And if we see changes taking place without any accompaniment of effort on our part, we do not suppose that we have caused these changes; we suppose them *caused*, only because we interpret them by the analogies of our experience. Is this a paradox? It needs but a glance at our psychological structure to read the clear evidence. Were our experiences limited to the Systemic Sensations, supplemented by Vision and Hearing, we might have a conception of the geometric universe, but we could have none of the dynamic universe. The conceptions of Form and Quantity, Space and Time, might be raised from those feelings; but the conception of Matter, Force, and Cause would be absent, having no basis in perception. The objective world would be a panorama of succeeding images, where Change and Coexistence might be discerned; but the Change would involve no Force, no Cause; the succession would be that of antecedence and sequence, not of cause and effect. One image following another, one sound accompanying one image or following it, there would perhaps arise in time a registration of the coincident images and sounds, and perhaps of

their coincidence with Systemic Sensations, which would yield a conception of Law. But without the experiences of pressure there could be no basis for the conception of Force or Cause. The origin of that conception is indubitably in the experiences of Pressure, active and passive, obtained through the movements of our bodies and the resistance of other bodies.* Pressure represents our experience of force under both aspects, that of a motor and that of the motion: the *force impressed* is not something outside of, and independent of, the body pressed upon; but is the excess of pressure exerted by one body, an excess which of course is relative to the counterpressure of the body pressed. Thus the pressure exerted by a cannon-ball moving with great velocity may be so slight relatively to the resistance of a castle wall, that the wall remains standing after the impact, and heat, not destruction, results from the blow; whereas the resistance of the wall may be so diminished by internal agencies that the blow will topple it over. Newton therefore defines an impressed force "an action exerted upon a body in order to change its state. *This force consists in the action only*, and remains no longer in the body when the action is over." What then does remain? Although

* Professor CHALLIS, who also holds that the forces of nature are pressures, thinks "it important to remark, that if we had only the sense of sight to guide us, we might conclude that bodies have the faculty of acting dynamically on other bodies at a distance."—*Essay on the Mathematical Principles of Physics*, 1873, p. 16. This is not in accordance with the analysis I have expounded, which excludes all dynamical conceptions whatever from the region limited to Sight. I am glad, however, to be able to cite his point against the idea of action at a distance: "By the sense of *touch*," he says, "we have a precise idea of contact as distinct from non-contact, of pressure by contact, and of pressing as a *personal* act."

Newton does not here propose this question, we know how he would have answered it. He would have said the impressed force is that which changes the state—is the item which has been added to the sum,—and the force of inertia is that which preserves the state thus changed—preserves the added quantity.

13. If we accept Force as the dynamic aspect of Existence, the correlate of Matter, we have a firm, speculative foundation for the first law of Motion, which expresses in an intelligible formula both the constancy of Existence and the varieties of its distribution. "A body always perseveres in its state of rest, or of uniform motion in a straight line, till by some external influence it be made to change its state." This is Newton's formula. That a body will not change its state unless there be some external cause of the change, is self-evident. But is it equally self-evident that, if moving, the body must continue uniformly moving in a straight line? We see that this is so; but our ancestors could not see it. We are enabled to place it on the same level as the unchangeableness of a body at rest; and to see that it cannot change its direction or velocity, unless there be some external *condition* of change. And yet, although this is a principle which seems so far contradictory to experience that it is never really exemplified—there being no real motions that are uniform and rectilinear—it is nevertheless a principle which was experimentally established, and was not even conceived until experiment had suggested it. I mean, that the principle was not conceived as a truth of general reach until it came out as the generalised result of experiment.

14. There have been many debates on this point.

Eminent philosophers have held, and some still hold, that this and other axioms are *à priori*, and independent of experience, because they cannot be experimentally demonstrated. But in this argument it is forgotten that what experiment discloses respecting the Sensible has only to be carried into the Extra-sensible to form the legitimate axiom of Experience, when these extra-sensibles become the rational equivalents of sensibles; otherwise no universal truth could be experiential, since every experiment must be particular. It is said that the axioms are given in the form of all experiences; but this is equivocal. The elements must be given in the experiences, if they are to be abstracted from the experiences; but the axioms are assuredly not present in experiences in their abstract shape as conceptions. We do not deduce the facts of motion from the laws of motion, but elicit the laws from the facts. We do not begin our observations with abstractions. In the case immediately under notice, it is notorious that, up to the time of Galileo, this principle of the uniform persistence of motion, so far from being conceived as an abstract truth, was not even suspected, so occupied were men's minds with the concrete truths which seemed to contradict it. Only a wider induction from more precise observations led to its conception; and although it is no longer quite true to say, "that we cannot know otherwise than by induction and experiment that the velocity communicated to a body will not become slower and slower of itself, and finally cease,"*—not quite true, because

* Poisson: *Mécanique*, § 113. In the first edition, § 183, Poisson is somewhat more guarded in expression, and says nothing of the body getting slower of itself, but only that it will get slower by the obstacles it meets.

now that the conception has been formed, it can be presented to the mind in terms which make it self-evident (such is the potency of conceptions*), yet we know historically that the evidence of experiment, which showed that as the obstacles were diminished the motion became more and more uniform and rectilinear, had to be generalised and extended before the abstract truth could be revealed.

15. And what did it reveal? The indestructibility of energy: that is to say, the motion which was diminished by the obstacles it overcame was energy because it overcame them; and when these were no longer opposing it, the motion continued undiminished, the energy of that motion being virtual, not actual,—abstract *capability* of doing work, if there were only work to be done.† Unless we assign this inalienable property of doing work to every particle of matter, as a *virtual*, which becomes *actual* when in relation to some other particle, we must either deny the axiom of indestructibility of Force, or declare Force to be something wholly independent of Matter, *sui generis*, not only in conception, but in reality.

16. Pressure arises in obstructed Motion, and all bodies, we are compelled to conclude, are either actually

* It is remarked by LAGRANGE that GALILEO, although he discovered the principle of the composition of forces, failed to see its application to all cases of equilibrium (*Mécanique Analytique*, p. 13). This application, so evident to us, was not evident to the great GALILEO; yet it was given in all cases of equilibrium, quite as decisively as the indestructibility of force is "given" in all experiences of force. Both the one and the other are conceptions to which Experience slowly leads, and which Reflection afterwards confirms.

† "Dans l'état d'équilibre la force n'a pas d'exercice actuel; elle ne produit qu'une simple tendance au mouvement; mais on doit toujours la mesurer par l'effet qu'elle produirait si elle n'était pas arrêtée."—LAGRANGE: *Mécanique Analytique*, p. 1.

or potentially moving, their motion when arrested by countermotion still persisting in pressure. Not only do we know that our planet is whirling round the sun, and that the sun with its satellites moves with immense rapidity through space, we also know that even in the bodies said to be at rest every molecule is vibrating, though not passing beyond the limit of oscillation. Not only is this deducible from the conception of pressure as the dynamis of Mass, it is also inductively reached. For since our planet is presumably never for two consecutive instants in the same part of space, no single molecule can for two consecutive instants be in the same relation to the sun; its temperature must therefore vary. We cannot see this, cannot measure it by Sense, but we see it by the eye of Science. In some remarkable examples we may even approximate to it by Sense. Thus, by the aid of excessively delicate instruments, the astronomer Cæsaris showed that the walls of the Milan observatory, seemingly so fixed and moveless, were subject to periodic oscillations, due to the varying action of the sun; and Pictet found that a metallic rod fixed in an upright position, became shorter, owing to the slow downward movement of its molecules, subject to the pull of gravitation. We may say, therefore, "that absolute Rest nowhere exists in Nature;" all that exists is "the condition of equilibrium, in which a point experiences no change of motion."* Therefore Motion, and change in the direction of Motion, Pressure, and change in the differences of Pressure, constitute the dynamic aspect of Existence. Assuming the energy of a molecule to be a constant

* THOMSON and TAIT: *Natural Philosophy*, i. 179, 182. POISSON: *Mécanique*, i. 231.

quantity, indestructible, the sum of all these energies must be constant, and the only variation can be in their directions, *i.e.*, their differences of pressure. We see in electricity how effects depend on difference of Potentials. Dissimilar metals in contact produce currents; nay, it is so even when there is only difference of temper in the same metal (as soft and hard iron, or brass).

17. It follows from this, that the mathematical fiction which makes Matter inert, and Force an external cause of change, is strictly consequent. But while it is logical to consider a force as external to the system on which it operates, since no system can operate on itself, a serious speculative error arises if the artificial nature of the distinction is overlooked—the error, namely, of personifying an abstraction, and creating an entity as the Agent apart from the Activity, a Cause which is not the effect.

FORCE AS CAUSE OF CHANGE.

18. When Force is defined, "*that* which causes or tends to cause a change of motion," if we ask, What is that? we are told by one very numerous class, that it is "what lies beyond human ken;" by another class we are referred to "the condition of the change."

19. I must here anticipate the conclusion respecting the nature of Cause, which will be established in Chap. II., and say briefly that Cause is the condensed expression of the *factors* of any phenomenon, the Effect being the *fact* itself. Cause is the group of conditions which pass into the effect, ideally distinguishable from the

product, but not really separable. In cause and effect there are not two things, one preceding the other, but two aspects of one phenomenon successively viewed. The effect is the *effectum*, the *causatum*, the *procession* of the cause.* The two things which may be said to co-operate are the two related terms of the operation; but we must not isolate these terms, and consider the one to be cause or antecedent, the other effect or consequent: since *isolated*, the terms lose all causal significance, and *related*, the one is not the product of the other, but both must co-operate in the causal relation.

If this statement excites the reader's opposition, he is requested to suspend all further consideration of the present topic until he has meditated on what is expounded in Chap. II.; or else he must take it for granted, and see how it applies in the following argument. All that need here be added is, that every cause is a plural,—the symbol of complex conditions, co-operant factors.

20. Thus viewed, what shall we say to the wearisomely iterated statement that man can know nothing of Force, because he can never know causes, only effects? Of course, if we have personified the distinction, and made cause something different from effect, existing apart, and creating the effect by a mysterious legerdemain, it is clear that we cannot know what we have thus banished from the region of knowledge; we know the effects, and cause is said to be something not these. Gravity, we are told, is the unknown cause by the action of which bodies fall to the

* "Toda la realidad del efecto ha de estar virtual *in causa*."—JAIME BALMES: *Escritos Póstumos*, Barcelona, 1850, p. 270.

earth if unsupported. We know the fact, the effect; and that is all. Now I say we know just so much of the cause as we know of the effect, since the cause is not one thing and its effect another. The fall of the bodies is the gravitation of the bodies. If you ask, What causes this gravitation? the answer may be, The differential relations of pressure; and if you ask, What causes these? the answer is, that you are travelling beyond the gravitation, and seeking a cause of the cause. The cause of sweetness is the co-operation of certain chemical combinations with certain neural combinations; to look beyond this relation, and seek for the conditions which determine the chemical compound, is not to seek the cause of sweetness, but the cause of the chemical combination. It is possible for research to pursue this regress of causation to great lengths, but at each stage it *shifts the problem;* and no success in solving other problems can add one iota of causal illumination to the particular problem from which we start. No insight into chemical combinations and neural combinations will do more than give a specific character to the symbols by which we express the fact that sugar is sweet to the palate, and is not sweet to any other organ.

21. But philosophers are lavish in the admission of unknowable causes, the creators of the knowable effects. Were not the genesis of this fiction intelligible, one might ask, How do you arrive at this knowledge of an unknowable cause present in the manifestations of knowable effect? For while in one breath insisting on the impossibility of our ever knowing causes, these philosophers in the next breath proceed to tell us a great deal about the unknowable. To cite but one

example :—A distinguished naturalist, in his *Discours d'ouverture* of the Belgian Academy of Sciences in 1872, declared, as if recalling first truths, "all natural phenomena are due to causes of which we know not the nature, and which I designate by the name of *forces*. I divide these forces into two very distinct categories: the one producing the physico-chemical phenomena; the other giving birth to living beings, and which, with the old physiologists, I name *vital forces*. These I consider *independent of Matter*, and only to be *communicated* to Matter by the action of a living being. They are subdivisible into those which give birth to plants and those which give birth to animals. The second may further be subdivided into the forces which animate brutes, and the force which animates man, and which I call the *soul*."*

22. Here, it must be confessed, we have a liberal display of very precise knowledge respecting the Unknowable; and we cannot but pause to inquire whence it is derived? what evidence is there—outside the classified phenomena—for any existent force operating in, but not identified with, these actions? We must not blow hot and cold with the Unknowable. We must not pretend to any knowledge whatever of it. If we are compelled to admit the relativity of knowledge, and consequently to admit an existence which is inaccessible, we are not thereby compelled to doubt the validity of our relative knowledge. Strange perversity of speculation, which declares that we do not know one thing because we do not know something else! The relation which is clear we render turbid by mingling it with what is obscure. Does any man believe that

* *Revue Scientifique*, 1872, p. 742.

he has not a full knowledge of the second power of 7, because he does not know the sixth power of 7 until he has calculated it,—that is, found out what the relations are? And if he calculates erroneously, will this error affect his knowledge of the second power of 7? Let him have ascertained that y is a function of x; will his knowledge of this relation be rendered doubtful because x may have other functions not yet ascertained? The question is absurd; and yet it is only another form of the metaphysical absurdity which declares causes to be unknown because we only know their effects, and forces to be unknowable because we only know their action in particular relations. I shall have to recur, in the succeeding Problem, to this Unknowable, when treating of Force as the Thing in itself. Here it is enough to point out the origin of the fallacy, which is the ideal separation of causes from effects.

23. In every action, every case of Force, we logically distinguish three aspects: there is 1°, the Agent, or moving object; 2°, the Motion, or Action; and 3°, the Motor, or Antecedent Condition, *causing* the change, as we say. We observe the Agent at rest; *i.e.*, there is a particular relation between that object and our Sensibility, which not being disturbed, the Agent is viewed in itself. A change takes place—another relation disturbs the former, and this changed relation we call a movement: and as we connect this change with some other object, the Motor, the new relation, is abstracted from these two related terms, and converted into an entity, Force. These logical artifices are indispensable; but we err greatly when we for-

get that they are artifices, and suppose that when a body falls it falls in consequence of any law of gravity or any force of gravity which is *not* the abstract expression of the fact of falling, but an outlying Agent operating on the body. We have already seen in what sense Force is to be considered as external, and in what sense internal: external, when we consider the antecedent of change, itself a change, the addition or subtraction of a dynamical factor; and internal when the action itself is considered. The Law of Invariants assures us that all force is internal as the action of the agents; and that the combination of one agent with another is, abstractly, external. Every agent which acts acts in relation to some other, acts *on* another, as we say, and, in this sense, is external to that other. But this is simply a redistribution of relations; what is added here must be subtracted elsewhere, if the constancy of Existence is to be maintained.

THE LAWS OF MOTION.

24. Let us see the Law of Invariants expressed in those three Laws of Motion defined by Newton. It assumes that Existence is constant, neither ceasing nor beginning to be; and further, it assumes that Existence under the dynamical aspect is Force either insistant or resistant—this aspect having reference to the relation of one existent to another. Each existent has a definite and inalienable quantum of activity or pressure, by which it persists, and resists the pressure of any other. It thus occupies Position, and can only be moved from that one into some other by a pressure

capable of overcoming the counterpressure. The sum of pressures in the system is constant, redistribute the integers how you will. The groups vary, the units remain.

25. The first law is an expression of this. It is another mode of stating the identical proposition that no change can take place unless a change takes place. Change of motion is an unit of force added to or subtracted from the system—it is motion compounded with motion, or liberated from opposing motion. In the second law we have another expression: "Change of motion is proportional to the impressed force, and takes place in the direction of the straight line in which the force acts." In other words, the *difference* of the action is simply the added difference. A system is moving; if to this system any addition be made, it will generate a proportionate increase or decrease in the movement, or a new direction of the movement; the increase, decrease, and direction being this difference. "It is to be particularly noticed," remark Thomson and Tait, "that nothing is said about the actual motion of the body before it was acted on by the force [that is the added unit]; it is only the *change* of motion that concerns us. Thus the same force will produce precisely the same change of motion in a body whether the body be at rest or in motion with any velocity whatever." This is the basis of the important principle discovered by Galileo, called "the composition of forces," or the "independence of motions." Note however one point. Unless we steadily conceive a force as a difference, and itself a composition of motions, we cannot correctly say that the same force will

produce the same change in a body at rest or moving with any velocity. I mean, if the "impressed force" be regarded as a quantum entirely independent of the resisting body, then this quantum added to the body at rest or moving will not always produce the same change. Take the muscular force expended in giving a blow, and view this expenditure as a definite quantum, it will produce one change in the state of a body at rest, another and much smaller change in the state of a body moving, simply because the force impressed is proportional to the resistance, and when the resistance is nearly zero, the change is nearly zero. If, on the other hand, we take the impressed force as a composition of pressure and resistance, then the Law of Invariants is satisfied: the change is the resultant.

26. The third law, "to every action there is always an equal and contrary reaction; or the mutual actions of any two bodies are always equal and oppositely directed," is generally found difficult of comprehension by readers unacquainted with Dynamics, but the Law of Invariants renders it intelligible. Every one knows that when he presses against a body it resists the pressure, but not every one understands why this resistance must necessarily be equal in amount to the pressure. It must be equal, because the force gained in one direction is the force lost in the contrary direction. When a seller acts on a buyer, inducing him to purchase, the sale is but the other side of the purchase; the money one gains the other loses; the goods the seller loses the buyer gains. The force with which a horse tows a boat is at each pull exactly equal to the

force with which the boat drags the horse. The boat moves forward, and the horse has his motion forward neutralised to an equivalent amount. If we do not see the horse actually dragged backwards, as we see the boat dragged forwards, this is because the horse has a surplus of force over and above that expended on the pull. If I give a beggar who has nothing threepence out of my last sixpence, I have beggared myself to the same amount that I have enriched him; he has reacted on my fortunes in the exact ratio to my action on his; but if I give him threepence out of my pocketful of money, although there has been the same ratio between the action and reaction, its effect on my fortunes is trifling. The horse is rich in force, and partly expends it in pulls at the boat; each pull diminishes the store; and after a while the horse will be unable to drag the boat forward, because the boat will drag him backward by an equal pull.

Suppose a body, A, moving with a velocity, 12, overtakes another body, B, moving with a velocity, 6; the result of their meeting will be a combination of these velocities in respect to any third body on which they may impinge, but a redistribution of their velocities in respect to themselves. They will both, if of equal mass, have a velocity, 9. A has lost 3, which B has gained; the sum remains as before, 18: between A and B there has been equality of action and reaction.

27. Since Force is realised in Motion, the Laws of Force are the Laws of Motion; and it is on this ground that modern science hopes to reduce the whole universe to Molecular Dynamics. The idea is resisted by many, because they persist in imagining something else in

Force, something which is the Cause of Motion, and that Cause inscrutable, or at any rate different from the effect.*

THE MANIFESTATIONS OF FORCE.

28. We have now reached a point of view from which a distinct conception of Force may be had. Setting aside the metempirical conception of Force as something apart from and independent of its manifestations—a Noumenon of which the observed actions are Phenomena,—we see that, both in the ordinary and the scientific acceptations of the term, it means simply the activity of Existence. Matter and Force are two abstract expressions for Agent and Activity.

* I will merely touch here on the separation of Velocity from Motion, and the disputes respecting the reality or the artificiality of the proportionality of Force and Velocity. D'Alembert thinks the law ought to be banished altogether, for he says "it is grounded only on the vague and obscure axiom that the effect must be proportional to its cause [which we shall presently see to be an identical proposition], and whether true or doubtful, clear or obscure, it is useless to Mechanics, and therefore should be banished."—D'ALEMBERT: *Traité de Dynamique*, Paris, 1796, *Discours Prelim.*, p. xi. DANIEL BERNOUILLI regarded the principle as contingent, because we, being in ignorance of the nature of cause and its manner of acting, cannot say whether the effect is really proportional, or whether it is not some function of that cause. POISSON at first regarded it as an hypothesis: "Car de ce que nous entendons par le rapport numérique des forces nous ne pouvons rien conclure relativement aux vitesses qu'elles produisent. Nous disons par exemple qu'une force est double d'une autre quand la première est formée par la réunion de deux forces égales à la seconde agissant simultanément et dans le même sens sur un point matériel; or il ne s'ensuit pas nécessairement que cette force double doive communiquer au mobile une vitesse précisément double de celle que la force simple lui communiquerait dans le même temps. La vitesse communiquée à une mobile par une force qui agit sur lui pendant un temps déterminé est une fonction du nombre qui représente l'intensité de cette force; le peu de données que nous avons sur la nature des forces [always this recurring fallacy!] ne nous permet

When we speak of physical forces, vital forces, mental forces, social forces, we mean—or ought to mean—the actions of molecular agents, organic agents, social agents. When we speak of the force (energy) of a projectile, we mean the mass, and its velocity as related to the work which will be effected on some other body when the projectile strikes it. A prospective glance at the effect sees the projectile energy as a cause; this cause is measured by its effect on the object struck, the *co-operation* of which is left out of account. And as we thus abstract one term of the relation, we are also led to abstract the relation itself from both the related terms, and view this cause apart from its conditions, this action apart from the agents acting, and then declare it to be

pas de déterminer *à priori* la forme de cette fonction ; nous sommes donc obligés pour résoudre les problèmes de la dynamique de partir d'une supposition ; et nous choisissons la plus simple en regardant la vitesse comme proportionelle à la force." This passage I extract from the first edition (p. 278) of the *Mécanique;* but if we turn to the third edition, issued twenty years later, we see that he no longer follows Bernouilli in declaring it to be an hypothesis, but regards it "comme une conséquence nécessaire de ce que les vitesses imprimées par des forces quelconques dans des intervalles de temps infiniment petits sont toujours infiniment petites, et de ce qu'en même temps les déplacements des mobiles sont aussi infiniment petits" (i. 215).

LAPLACE regards the proportionality as an induction from experience; Force, he says, being only known by the space which it causes a body to describe in a given time, we naturally take this space as its measure. We cannot know *à priori* that force is proportional to velocity, because we are ignorant of the nature of force; and there would be no contradiction in supposing the force equal to the square of the velocity. He then shows how the principle of proportionality follows as a consequence from the principle of the independence of motions (the second law of Motion discovered by Galileo).—LAPLACE: *Exposition du Système du Monde*, 6th ed., 1836, i. 278. DUHAMEL also rejects the idea of its being an hypothesis, and says it is the foundation of dynamics verified by experience. —*Cours de Mécanique de l'Ecole Polytechnique*, 1845, i. 239.

the *manifestation* of some unknown or even unknowable Cause. A serious error. There is nothing in the action but the action itself; what preceded the action, what lies outside it, is not *this* force, but another. *A thing is what it does.* What it is and does may be determined by something which acts on it, since all things are related; but the particular group of relations specified *is* that group, and not another.

29. Consider a single example: Among the observed actions of liquids and gases there is one named Diffusion, and the cause is said to be a "diffusive force," —obviously a mere translation of the observed fact. This cause is the effect, and the maximum of effect (the maximum of diffusion) is at the moment of contact and at the surface of contact of the two liquids or gases; that is to say, where the rate of change per unit of distance is greatest. The law or fact being that difference of rate determines the diffusion, we see at once that the rapidity of the diffusion will gradually diminish with the diminishing rate of change—the exchange is a function of the rate. When, therefore, we are told that the *same* force varies in intensity according to the differences of rate, we are simply re-stating the fact that the cause, being identical with the effect, varies with the effect: the force which is the so-called manifestation of this cause varies with the varying conditions of its existence; but to call this varying force the same force, is to say that changing relations are the same relations. It is the same force in the sense of being an action of the same kind.

30. It is obvious that if Force is Activity, the forces

are infinite, since the combinations of agents are infinite. Nevertheless, the purpose of science being classification and reduction of multiplicity to unity, all our efforts are directed towards a systematic selection and classification of actions under well-marked groups. Out of the infinite variety of incessant changes we select those that have constant characters, and these are our finite forces; numerous as they are, they admit of being grouped under a few heads. They may be compared to the tones which we distinguish from noises. Noises are the irregular mingling of vibrations; tones are the regular recurrence of vibrations: both are ultimately reducible by analysis to simple pendulum movements of the air, but the definite and constant character of the periodically recurrent vibrations detaches them from the indefinite and variable noises, so that out of them Music is constructed, as out of the forces Science. The tones and the forces are measurable, because their relations are constant. We recognise two tones as in unison, however various their *clang*, when their periodic vibrations are numerically identical; and we say two forces are identical, however various their accompanying phenomena, when their mechanical relations are expressible by the same quantities.

Whether all forces are manifestations of one Force, is a metaphysical question. Its answer will depend on, 1°, whether we choose to disregard all Diversity, as if it were not equally with Identity a fact of Feeling; or, 2°, whether we are considering the universe as it is reflected in Thought, or as it is reflected in Feeling.

Into the many deeply interesting details which Science has collected respecting the actions of material objects I cannot enter here, but in the Appendix will be found some remarks on the metaphysical question of "Action at a distance." (Appendix C.)

CHAPTER II.

THE MEANINGS OF CAUSE.

31. LIKE its synonym Force, the word Cause sometimes means an antecedent, sometimes a process, and is sometimes a condensed expression for antecedent, process, and product.* We say "a spark causes the explosion of gunpowder," or "the man was drowned because his foot slipped in crossing the plank;" here out of many factors one is arbitrarily chosen as the cause, from its being the conspicuous antecedent. We also say "gravitation is the cause of the body's fall," "contractility is the cause of muscular movement," "assimilation is the cause of growth;" here an abstract expression of the process is put for the initiation of the process. Obviously the fall is not really consequent on gravitation, in the sense of being produced by it; the gravitation of this body is its falling; the

* "Cause, that which produces or accomplishes anything."—JOHNSON: *Dictionary.*

"Cause, a substance exerting its power into act, to make one thing begin to be."—LOCKE: *Essay.*

"Cause is to be conceived as some abstract quality, power, or efficiency, by which change is produced; a quality not identical with the events, but disclosed by means of them."—WHEWELL: *History of Scientific Ideas*, i. 184.

The Sanscrit root *fr*, which means "position in front," gives us *for* and *therefore*, which express the cause.

muscular movement is the muscular contraction. We habitually consider cause as change, and yet declare every change to have its cause. Hence the word sometimes means the action observed, and sometimes an antecedent of that action. But mere antecedence never suffices; nor even invariableness of antecedence, unless that invariableness means a *procession:* the antecedent must *enter into* and become *incorporated* in the consequent, otherwise we ought not to call it a cause. Hence every cause is efficient, and passes into its effect: the process and the product are one, viewed under two aspects.

32. Now it would be a vain effort, and, if successful, would probably lead to inconvenience, were we to disregard these deeply-rooted usages of language. We may, therefore, continue to *speak* of cause with ordinary latitude; yet it is eminently desirable that we should learn to *think* of it with precision, so that at any moment we can interpret the symbol into its significates. All the vexed questions which have been raised respecting Causation turn on the illusory separation of process and product, cause and effect, which is properly a distinction of aspects, not a separation of reals; the antecedent is not one thing, and the consequent another different thing, following it, flowing from it, originated by it, as the offspring from its parents.

When Hume puzzled the world with his sceptical argument, showing that the idea of necessary connection between cause and effect was merely a prejudice of custom, alarmed Philosophy sought everywhere for proofs of a connexus and evidence of this *power*—evidence confessedly not given in sensation, and which

nevertheless was assumed to be discoverable somewhere; so that Kant's announcement of Causality as one of the forms of Thought, and thus one of the conditions of Experience, was eagerly welcomed. Men breathed again, and thought the fabric of the universe secure. They were then quite at ease in admitting that we could perceive no necessary connection between one event and another, could have no sensible intuition of the power which caused one body to change the state of another. Causality, the law of our mental constitution, was not a perception, but a necessary condition of perception.

33. The experiential school rejected Kant's solution, and only so far modified Hume's sceptical solution, in that it replaced the prejudice of custom by *unconditional invariableness* of antecedent and consequent. This fact of sequence was held to be objective no less than subjective; and it was because events did succeed each other in this order that we learned to believe in the order; we learned to believe in it because inseparable association prevented our believing anything else. But, said these writers, although there is this sequence, it does not involve any such reality as that expressed in the abstraction Power; nor are we to suppose that the sequence has any "internal necessity," so that, in other worlds, the same sequences would be observed. Indeed, it is conceivable that, in other worlds, the laws of Causality would not operate; and not only might effects there occur uncaused, or causes be unfollowed by effects, but even numerical relations might vary, and 2 + 2 might be 5.

34. When Mr Mill startled his readers with this

last result of his premisses, it ought to have opened their eyes, if not his own, to a radical error in those premisses. But instead of their questioning the premiss of "effects being different from their causes," their scepticism fell upon the psychological justification of our belief in cause. To Mr Mill it seemed only worthy of the schoolmen to adopt the axiom *causa æquat effectum.* Instead of saying an effect must be like its cause, he insisted on the necessary unlikeness. Here the mists became impenetrable. They gathered more and more when the effects were studied. For example, it has been observed that the administration of mercury is followed by paralysis. The mercury, or antecedent, is said to be the cause; the paralysis, or consequent, the effect. Could any two things or events be more unlike? Can we say that the cause, mercury, has among its properties the peculiar property of paralysis? We cannot, for we know that paralysis is a condition of the organism, not of the metal; and it is only in this special conjunction of these two agents—metal and organism—that this result appears. Nay, more; the paralysis is observed where there has been no administration of mercury; whence we conclude that it is simply an altered state of the organism; but since the organism cannot alter itself, there must be some other factor to replace the mercury. Thus in every case the effect will be the product of its factors, never of one factor; the effect will be the completed process, and the *efficient causes are the factors in that process.* The immobility of the muscles named paralysis is due either to a defective innervation, or to some alteration in the con-

dition of contractility. The pathologist endeavours to decompose this complex fact into its component factors. Following the course of the mercury, he finds one indispensable condition to be the existence of the metal in the blood as an albuminate held in solution by chloride of sodium. Why? Because solid mercury will not pass from the blood to the tissues; and even when fluid, it will only pass through the walls of the blood-vessels under certain osmotic conditions. Here, in this first factor, how great a complexity of causes all co-operant! A second step in the investigation brings us into presence of the mercury acting on the tissues. For this action we coin a phrase like "elective affinity," to express the fact that one tissue has, and another has not, the tendency to take up into itself the albuminate of mercury, and thus be poisoned. A third step reveals the mercurially poisoned tissue incompetent to carry on the vital activities proper to the normal tissue.

35. In this example three points are noticeable: first, the plurality of causes which determine the final result; secondly, the arbitrary selection of one out of the complex elements of the process to stand for the determinant; thirdly, the obvious want of resemblance between *this* supposed determinant and the result determined. The administration of mercury being taken for the cause or antecedent, the paralysis, which is not the immediate consequent, but one dependent on many intermediate antecedents, is taken for the effect. That the one event is prior to the other is a fact of observation; but that the one event is in *direct* relation to the other, or has a mysterious power over

it, making it come into existence, is not only no fact of observation, but is no logical conclusion. What we observe is a phenomenon here, and another phenomenon there. The dependence of the one upon the other, whatever it may be, is clearly something more vital than mere antecedence in time. This has been the conviction of thinkers, who, dissatisfied with the doctrine of Hume and his followers, have insisted on the relation of cause and effect as one of power. "Why does this particular sequence, and not another, follow this antecedent?" they ask. Why does oxygen combine with hydrogen to form water, or the spark cause the explosion of gunpowder, unless there is some power at work? Mere antecedence is not power, nor will the epithet "unconditional" convert antecedence into power. There must be a real nexus for a real change.

36. Mr Mill, unable to rid himself of the traditional idea that a cause is simply an antecedent, and aware of the objections against mere invariableness of antecedence, tries to obviate them by substituting *unconditionalness* of antecedence. But this is open to serious objection. Unconditional means either *absence of conditions*, or *absence of counteracting conditions.* In the first case, the term cannot be applied to causation, since no product can arise in the absence of its factors; in the second case, we must interpret it as meaning that a sequence is only invariable when its antecedent conditions are invariable; which is indisputable. That Mr Mill was somewhat confused on this point may be seen in his surprising conclusion that the orbital movement of a planet is not a case of causation—

his reason being, that it is dependent on the conditions of the sun's attraction and the tangential movement; and being thus *conditional*, it is not reducible to the formula of unconditional antecedence. Here a cause is supposed to be cause only when there are *no conditions*, and not simply when there are *no counteracting conditions*. Again, when considering the arguments of Herschel in favour of the simultaneity of cause and effect, he expresses his willingness to give up the words antecedent and consequent, though he thinks the concession needless, and adds, "I have no objection to define a cause the assemblage of phenomena, which occurring, *some other* phenomenon invariably commences, or has its origin. Whether the effect coincides in point of time, or immediately follows the hindmost of its conditions, is immaterial." Here it is clear that he had not recognised the identity of cause and effect, of factors and their product. He clings to the old notion of the effect being some *other* phenomenon, and not the same phenomenon differently viewed: the assem*blage* of phenomena and the assem*bled* phenomena are not two, but one; the action and the act are but the diverse aspects of the event. They are born together, *συμπεφυκότα*, as Plato would say.

THE IDEA OF POWER.

37. Rejecting this notion of antecedence, we return to the old notion of a power creating the effect. It is no doubt a misleading notion, but it expresses a real fact of experience, and therefore should be interpreted rather than rejected.

We see the mill-stream falling on the mill-wheel,

and see the wheel turning as the water falls. We say, therefore, that since the wheel cannot turn itself, it is the water which causes the turning; and the water does this because it has the power to do it. Obviously here the power is the doing: the action represented in a symbol. The water is, acts, in this relation to the wheel; and since it can act on other wheels and other things—existing in other relations—we abstract this possibility of action, and call it the power of water. On investigation this power proves to be the weight of the water; and weight we regard as motion towards the centre of the earth; so that the relative position of the water and the earth's centre is that which determines the turning of the wheel—if we do not take into account the equally operant conditions of the wheel itself. The noticeable peculiarity here is, that we do not assign the power to the water seen, but to the unseen weight; and this because all explanation is a looking away from the visible fact in search of the invisible factors. But when we have found these, they in turn demand an explanation; and thus we get no nearer the fact when we substitute weight for falling water; we only connect ideally the fact with a series of similar facts.

38. Power, then, is our abstract expression for the action of the agents. Causation is this action, and it is nothing more. Unless the actions of agents are related, there is no result we call effect. Unless forces are in the same plane—or in parallel planes united by the lever arm, which dynamically reduces them to one plane—they have no resultant; each subsists for itself, but they do not subsist in each other. Unless agents—causes—are in the same group, they have

no resultant action, no effect; each subsists for itself. The *cosa* is *causa* only as *causatum, effectum.* The effect, product, is to the cause, process, what the act is to the action, and the action to the agents.

Once recognise the identity of cause and effect under obverse aspects, and these aspects may be interpreted by antecedent and sequent, without necessitating any mysterious intermediation of a third agent or link connecting them. When 2 are added to 3, and these combine with 5, the sum 10 simply is these combined integers; nothing has been interposed between 3 and 2, and between these and 5; the operation of combination is simply their relation. Each number has its property, its value; the sum is the total of their values. So when oxygen combines with hydrogen and forms water, they, with the electricity which brought them into union, may be said to be the causes, and the water the effect; but obviously the water is what they are in this relation. Fabre and Silbermann find that chlorine combining with oxygen to form chloric acid absorbs a certain amount of heat, which they symbolise as a negative quantity: $-a$. Potassium, in combining with oxygen, on the contrary, disengages heat; this they express as a positive quantity: $+b$. The chloric acid and potash thus formed combine to form chlorate of potash, and in doing so disengage more heat: $+c$; so that their combining heat is $b + c - a$. By generalising this result, it is seen that the total heat of a chemical combination will be the algebraic sum of the combining heats of each of its compound constituents; and generalising still further, we may express it in the terms of pressure or force, and say that *every effect*

whatever is the algebraic sum of the pressures of all its agents.

39. Thus what is supposed to be the causal link, the power which establishes the *nexus* between one event and another, is not anything over and above the action of the co-operating agents. The thing is what it does; its action is its existence. We abstract the action, and personify the abstraction. Thus all the mystery needlessly thrown round the conception of Power disappears when we reduce it to its sensible concretes. As a symbol it has two significations: either it is the name by which we express the abstract Possibility of an agent's activity, and foresee that, when this agent is placed under certain relations, certain results will follow; or it is the name by which we express the activity itself. The power which we suppose to exist in a barrel of gunpowder, capable of blasting a rock, is a mere possibility while that barrel of gunpowder stands there before us; but we *foresee*, what has before been *seen*, namely, that when the powder is ignited, and has passed from *powder* into *expanding gases* under definite pressures, this new combination of the agents has a new resultant action: the rock is shattered. The energy of the explosion is the sum of the energies of the grains of powder, which was originally expended in forming the powder, when the gases united together, and were condensed in grains of solid powder, and is again restored when the grains expand into gases. It is mere tautology when we speak of "the power by which a cause operates." The power is the operation. If 2 be added to 2, the result is 4; if oxygen be brought into a certain relation with metals, the result is an oxide of each metal; if carbonic acid be thrown

into the air of the room in certain proportions to the amount of oxygen, the lights burn faintly and the animal pulse beats feebly; if the quantity of carbonic acid be increased, the lights go out, the heart stops. To say that the co-operant causes have the power of doing what they have done is not instructive. To seek for this power elsewhere than in the relations of the related terms is to pursue a phantom.

40. But this phantom allures speculative curiosity. We not only seek for the cause of an event, we seek for a cause of the cause.

To seek the causes which are the factors of a fact, the conditions under which the event occurs, is the true aim of science. The quest of rational research is *the ascertainable order of dependence* in phenomena, and not the futile *why* of this order. We know the causes when we have ascertained the laws. Owing to the want of clear conceptions prevalent about the Laws of Nature, there are many thinkers unable to rid themselves of the belief in some metempirical figment—some hidden Power which stands for Cause, and which is not disclosed in Law, but acts according to Law.

It is thus Reid speaks of Newton's great discovery: "The author was perfectly aware that he had discovered no real cause, but only the law or rule according to which the unknown cause operates. Natural philosophers who think accurately have a precise meaning to the terms they use in science; and when they pretend to show the cause of any phenomenon of nature, they mean by the cause a law of nature of which that phenomenon is a necessary consequence. . . . . The laws of nature are the rules according to which the effects are produced; but there must be a cause which

operates according to these rules. The rules of navigation never navigated a ship; the rules of architecture never built a house." *

41. There is an instructive fallacy in this argument. That a ship will not be navigated, nor a house built, by any enumeration of the rules which have been abstracted from the phenomena, is true enough; nor will an universe be created by an abstract of its laws. Abstractions have no efficiency. But if, instead of regarding the rules or laws in their abstraction from phenomena, we regard them as the abstract expressions of the concrete relations actually involved, it is obvious that the ship is navigated and the house built by those concurrent causes which we express in the stated laws. "Upon the theatre of nature," Reid continues, "we see innumerable effects, which require an agent endowed with active power; but *the agent is behind the scene.*" What is this hidden agent but a personification of our abstraction?

Chemists ask, What is the cause which determines oxygen to quit the atmosphere and unite with iron or lime? The fact of combination is observed, and the agents are known; but something behind is imagined. When they have called this combination "affinity," many suppose they have here a new agent, a cause. Wiser heads know perfectly well that only a word has been invented.† The word is a symbol which expresses the observed fact. If this fact be resolved into factors not previously apparent, into conditions

* REID *On the Active Powers*, chap. vi., *Works*, ed. HAMILTON, p. 527.

† "Cette force on ne le connait pas," says M. DUMAS. "On sait seulement qu'elle ne s'exerce qu'au contact apparent des corps, qu'elle devient insensible à des distances sensibles."

which co-operate in the result—such as external pressure, temperature, &c.—the symbol, "Affinity," receives a new significance, condenses more observations.

42. Thus the term Affinity, or Cause, expresses our knowledge of the observed relations, and our ignorance of those unobserved. If two solutions—nitrate of lime and sulphate of soda—be mixed, a curious effect is observed; a solid deposit of *sulphate* of lime is formed, and an equivalent amount of *nitrate* of soda remains in the liquid. To interpret this observed effect by assigning it to Affinity, is merely rebaptising the observation; but the term acquires a new fulness when it embraces new observations, directed to relations not before apparent. Thus Berthollet directed attention to the fact that generally when two saline solutions are mingled, and out of the four salts capable of being formed one of them is not easily soluble, this one is the first to form, and then its formation determines that of the complementary salt, no other issue being open. This fact he brought to bear, and showing that sulphate of lime is not easily soluble, he explained why it is the first to be formed. Here Affinity received a new significate. The old observation was not disturbed, it was enlarged. Berthollet, pursuing the inquiry further, attributed the greater insolubility of the sulphate of lime to its greater cohesion. This again was only rebaptising the fact. What are the conditions of cohesion? We are only able to refer them to Pressure; and Dumas has proved experimentally that solubility is in inverse ratio to condensation.

CAUSE AND CONDITIONS.

43. Every event that happens has a cause, everything that exists is a cause. This is evident. For an event to happen, there must be a change in existing relations; and this change must be the result of some previous change, a redistribution and reconcentration of the factors. The old aphorism, "Everything has a cause," is intelligible only when interpreted as everything is an agent, the action of which, combined with the action of some other agent, results in a new event, phenomenon. Every effect, change, is, as the Germans say, *bethinged* (*bedingt*). The causes, conditions, agents, of this change are the *bethingings* (*Bedingungen*).

Hence the common distinction between a cause and conditions is to be accepted only as a logical artifice, which throws especial emphasis on *one* out of many co-operants. Every event must be a conjuncture of conditions; and each variation in any one of these determines a corresponding variation in the event, though we are not always able to trace this. When Faraday was experimenting on the way in which lycopodium spores arranged themselves on a vibrating plate, in groups at the points of greatest motion, unlike the grains of sand, which collected at the nodes (where the motion was least), he had before him a case of what is commonly called different effects from the same cause. But being deeply impressed with the scientific spirit, Faraday looked about to discover what difference there might be in the conditions. It occurred to him that the very lightness of the lycopodium spores might have something to do with it. He tried

the experiment *in vacuo*, and then found that the spores arranged themselves precisely in the manner of the sand, thus showing that the vibrating plate had caused eddies in the air, and in these eddies carried the light spores, though unable to carry the heavier sand. The important differences which may result from apparently unimportant conditions is well illustrated in an example we owe to the sagacity of Professor Tyndall. Eminent physicists had asserted, on the faith of their experiments, that various chemical precipitates all manifested the same radiation of heat; and concluded from this, that when bodies are reduced to an extremely fine state of division, the influence of this state entirely overrides the influence of chemical constitution. But there was one "condition" not allowed for by them, which proved to be "the cause" of this uniformity of radiation; it was their use of a varnish of transparent gum, which being opaque to the rays of heat, nullified the differences in the radiant powers of the substances. The experimenters "saw their red powders red, their white ones white, and their black ones black, but they saw these colours through the coat of varnish which encircled every particle of their powders."*

44. We see, therefore, the justification of the proposed definition: an effect is the procession of its cause —or, more rigorously, the coalescence of its co-operant conditions. I use the word *cause* as a singular noun, because that is the established usage, but remind the reader that it is always an expression of at least two conditions—an integral of many differences. Nothing acts by itself, nothing is in itself; but we isolate a group, and treat it as a unit; we abstract

* TYNDALL: *Fragments of Science*, 1871, p. 240.

one agent, or one term of a relation, and view it by itself. An acid is not an acid except in its reactions; but we consider it apart, and say that when this acid, which has the power of uniting with an alkali, is brought into combination with the alkali, it produces a salt. This salt again we isolate in abstraction, and endow with the power of producing a chloride, when acting on chlorine.

45. Helmholtz remarks, that Matter and Force, being abstractions, can never be direct objects of Observation, only the *inferred* causes of the facts of Experience; how then can we prove from Experience that every event must have its cause, when we place the abstractions which can never be objects of Experience as the ultimate ground and sufficient reason of all phenomena? * The answer is, that although the abstractions are not objects of sensible Experience, the concretes expressed by these abstractions are sensible experiences; and since each sensible event is proved to have its cause, all are thereby proved to have their causes.

The fact that it is a convenience to select some one element out of the group, either for its conspicuousness, its novelty, or its interest, and we call it the *cause* of the change, throwing all the other elements into the background of *conditions*, must not make us overlook the fact that this cause—this selected condition—is only *effective* in coalescence with the others. Every condition is causal; the effect is but the sum of the conditions. Force being understood as an *added* pressure in one direction, a cause, which is its synonym, may be understood as the *added* condition, that which changes existent conditions. According to the pur-

* HELMHOLTZ: *Physiolog. Optik*, p. 454.

poses of the moment, we say that the cause of the apple's fall is gravitation, or the wind, or the gardener's scissors. While the apple hung upon the tree the pull of gravity operated, but was counteracted by the pull of cohesion; and so long as these forces were balanced, gravitation could not cause the fall; some new and additional force was needed, and it is this addition—wind or scissors—which, being conspicuous, we name the cause.

CAUSE AS ANTECEDENT.

46. Hence by a slight rectification we may adopt the generally received, but very misleading, idea of cause as the one antecedent event in any given sequence. We may then distinguish conditions from causes, as the forces in equilibrium from the forces which disturb the equilibrium and produce a change. The cause represents that addition or subtraction of an agent by which a redistribution of pressures is effected. The misleading tendency of such distinction is to keep up the confusion respecting cause and effect as two different phenomena. Even Mr Mill does not escape this confusion, although at times he expresses himself with precision; as, for example, when he says that in "every act of causation the cause is the sum total of the conditions positive and negative taken together; the whole of the contingencies of every description, which, being realised, the consequent invariably follows,"—in other words, the effect, or consequent, is the procession of the causal agents; but the supposed antecedence and sequence is really simultaneousness, ideally distinguished by us when we consider the several agencies before and

after their combination. We observe a process, a change; and to explain it we reverse that process ideally, and see the agents apart from their action in this particular case. A glass of punch is *made* by adding together whisky, water, sugar, and lemon; each of these elements we know separately, and know them as the causes of the punch. But this causal character is only possessed by each in combination with the others; separately the agents are whisky, water, sugar, and lemon, with abstract possibilities of action of varying kinds. Really, therefore, the cause of the punch is the whole group of these combined conditions; and the punch does not *follow* from their combination, it *is* their combined action.

47. We must understand, therefore, that the distinction of antecedence and consequence is purely logical. Causation is procession. By a law of the mind, any two events accompanying or succeeding each other will be ideally separated and ideally connected. The rotations of the axle and the wheel will be separated as different; the application of an acid will be separated from the reddening of the vegetable blue; and again both will be connected. On investigation it turns out that the movements of the axle and the wheel are parts of one system, and the reddening of the blue is the incorporation of the acid. Each agent produces its effect, *is* its effect, instantaneously; and when we note a finite time elapsing between two events, two moments of a change, this is not filled by the *transition* of cause to effect, but is an arrest of the action, due to intervening causes. Sir John Herschel remarks, that "whenever *sequence* is observed, it is an indication of indirect action accompanied with a

movement of parts." Thus if we bring a magnet near a needle, the needle rushes towards it. This effect is said to be caused by attraction. But the attraction is reciprocal. And although we for our convenience separate the attraction from the motion, calling the abstract possibility the antecedent, and the concrete actuality the consequent, yet we know that there are not two things, one following the other, but one thing, the motion. Could a cause exist as such *before* its effect, it could exist *without* its effect; but as the two are correlative aspects of the one event, this is impossible. As an agent, cause has activity here or elsewhere; this abstract activity is its value, which, when combined with other values, makes a sum of co-existent values or effect.

48. The ideal separation of antecedent and consequent is the separation of one among the concurrent conditions from its union with the others. The flash is antecedent to the sound of the explosion, but the flash is not the cause of the sound; it has no procession in the sound. The flash is an effect: its causes are the vibrations of the ether, and the changes thereby produced in the state of the optic centre; the sound is an effect: its causes are the vibrations of the air, and the changes thereby produced in the state of the auditory centre. If we submit each of these in turn to analysis, and ask, What causes the vibration and the neural changes? we begin an inquiry which may lead back to the primeval fire-mist, and from that to "Chaos and old Time." But at each stage of the inquiry we have ascertained the causes when we have ascertained the co-operant conditions; what these conditions are in abstraction the effect is in reality.

49. We have already seen that the habit of fixing

on some one or two conspicuous agents as the cause of a change, because this *addition* disturbs the existing relations, is consistent with the definition of force, "that which produces or tends to produce a change." On this ground we say "The last feather *breaks* the camel's back," and "The man was drowned *because* his foot slipped in crossing the plank." No one supposes that the weight of a feather would break the back of a camel, or that the man could be drowned unless he fell into water of a certain depth of less specific gravity than his body, and there was no one at hand to assist him, or he was unable to swim ;—these conditions, positive and negative, are left unspecified, being presupposed, and only the new conspicuous condition is specified as the cause.

50. Yet note the consequences of this disregard of all the co-operants. Even so eminent a thinker as Mr Mill is led by it to regard the scholastic axiom *cessante causâ cessat et effectus* as a fallacy worth signalising. "Kepler's numerous attempts," he says, "to account for the motions of the heavenly bodies on mechanical principles were rendered abortive by his always supposing that the agency which set those bodies in motion *must continue to operate in order to keep up the motion which it at first produced.*" Kepler was wrong, but Mr Mill does not point out the error. Had Kepler *meant* what Mr Mill *says*, namely, that the motor agency must continue to move with its original energy unless checked externally, and that the bodies would cease moving unless this energy continued operant—he would have meant what is expressed in the law of inertia. His error lay in supposing that this motor agency must not simply persist in the energy of

the moving bodies, but must incessantly be *added* to that energy in a continuous *succession* of external impacts; but repetition of the original impact would produce accelerated motion, the acceleration being these multiplied impacts. Kepler was therefore right in saying that the original amount of force must persist if the motion were to persist; only wrong in supposing that this amount would remain unchanged under a repetition of impacts. The force was not a determinant separable from its determined.*

51. Mr Mill indeed,—and in this the vast majority of philosophers agree with him,—regards the notion of a cause being like its effect as a vulgar error.† It is only an error when *one* of the many components is arbitrarily selected as the cause, and the *whole resultant*, or the final stage of the process, is selected as the effect. If we say that a spark falling in a powder-mill causes the death of fifty persons, there is obviously no sort of resemblance or equivalence between this cause and this effect. But in truth the spark is here only the first in the series of conditions, and its effect is limited to the transference of some of its molecular agitation to a few grains of powder; these grains transmit their agitation to the mass, the expansion of the gases passes into the destruction of the mill, &c. If we limit causation to mere antecedence and sequence, the destruction of the mill is not the effect of the spark; but if we understand by cause all the factors, the destruction of the mill is their resultant effect. It

* "La fuerza determina las cosas, ó por mejor decir, es la misma determinacion de las cosas en el curso de las acontecimientos."—NIETA SERRANO: *Bosquejo de la Ciencia Viviente*, p. 260.

† MILL: *Examination of Hamilton*, p. 191.

should be remembered that we are sometimes dealing with effects which are simple and direct results of the factors, and sometimes with effects which are complex and indirect results. The factors unite to form a group or product, in the one case; in the other, this group or product becomes the factor in another group, and this product of the two becomes in turn the factor of a third. Now this last resultant is necessarily unlike the first, and still more unlike its separate moments. Yet the first cannot be said to cease operating in the last—it continues to operate as a factor. Each antecedent passes into, and is reproduced in, its consequent. Mr Mill more than once asserts the independence of the cause and its effect, and declares that effects continue long after the causes have ceased—which is a truism if cause mean simply antecedent, and is not supposed to persist in the consequent. "A *coup de soleil*," he says, in a passage repeated in all the editions of his *Logic*, "gives a man a brain fever: will the fever go off as soon as he is moved out of the sunshine? A ploughshare once made remains a ploughshare without any continuance of heating and hammering, and even after the man who made it has been gathered to his fathers." We have here a repetition of the argument urged against Kepler. It is surprising how so cautious a writer could fall into the mistake of confounding so cumulative a result as that of brain fever with one of its antecedents (that of the sun's rays), overlooking all the many concurrent conditions absolutely necessary to the result. Nor is this surprise lessened when we find him mentioning cases wherein the continuance of the cause is necessary to the continuance of the effect, such, instance, as the continued pressure of the atmos-

phere to sustain the mercury in a barometer: "There is therefore a distinction to be drawn. The conditions which are necessary for the first production of a phenomenon are occasionally also necessary for its continuance, though more commonly its continuance requires no condition except negative ones. Most things, once produced, continue as they are until something changes or destroys them [this is very lax language: *all* things continue as they are until they are changed], but some require the permanent pressure of the agencies which produced them at first."

52. Now although distinctions of this kind pass well enough in the rough classifications of ordinary speech, they are singularly misplaced in a scientific treatise. Unless we clearly fix in our minds that effects are equivalent to their causes, being indeed simply the processions of these causes, we shall never understand Causation. All the gratuitous mysteries of efficiency, power, causal nexus, &c., arise from the notion of a something interposed between the agent and its action, the cause and its effect, which "something" is supposed to generate in an inexplicable manner the observed phenomenon. The "something" is the logical synthesis of the co-operant factors: when the synthesis is known, the mystery disappears. Thus the chemist, having slowly oxidised alcohol by submitting it to the influence of powdered platinum, finds the first product to be an aldehyde, that is to say, an acid from which hydrogen has been withdrawn;* and as this is a very unstable acid, difficult to preserve, it readily passes into acetic acid by a further oxidation. Here then is a double process, in which the factors are

* Aldehyde is the abbreviation of *alcohol dehydrogenatum*.

known, and consequently seen in their products, which can be expressed in two equations:

$C_2H_6O - H_2 = C_2H_4O$; or alcohol minus hydrogen *is* aldehyde.
$C_2H_4O + O = C_2H_4O_2$; or aldehyde plus oxygen *is* acetic acid.

The chemist here seeks for no further cause, for he has the cause in having the factors. He can cause alcohol to become, or prevent its becoming, acetic acid at will.

Far otherwise is the obscurity of the process by which an albuminous substance is slowly oxidised in the animal organism. Here, although the final result is known, and some of its elements are known, the way in which the actions succeed each other is unknown. We cannot at present express these in an equation.

53. In conclusion, remark how the attempts to reduce Causation simply to antecedence is a recurrence to the First Notion of philosophers, who failed to recognise *immanent powers* in agents, but regarded the agents as passive, and placed outside them or inside them an operator directing them. Hence the scholastic distinction of Efficient and Final Cause: in the first was presupposed the action of a substance; but as this action itself was thought to require a cause, the second came to explain it as due to an intelligence; so that while *efficiency* determined the action, *finality* determined the efficiency (§ 54). This First Notion has to give place to the scientific Conception of agents as active, and of causation as the action of the agents. The search, therefore, for a causal nexus, a link between causes and effects, is chimerical. And this was the meaning of Laplace when he answered Napoleon's objection, that God was never once mentioned in the *Mécanique Celeste:* "Sire, I had no need of that hypo-

thesis." He had found the factors, and explained their mechanical relations; these explained the mechanism of the heavens. He might have gone further, and explained these factors as the modes of the divine agency, but this would have been another inquiry, which would not have been that of the celestial mechanism. He might firmly have believed that God ordained the relations: thousands believe it who nevertheless do not introduce it into their explanations. Even Padre Secchi, a Jesuit, and living in Rome itself, holding office under the Pope, can publish a book on the physical forces in which there is scarcely even an allusion to God—he also had "no need of that hypothesis."

THE FOUR CAUSES.

54. Aristotle, and after him the schoolmen, misled by difference of names for different aspects, taught that there were four kinds of cause: the *material* (ἐξ οὗ, or that *out of* which the effect proceeded—*i.e.*, the substance, ὕλη); the *formal* (εἶδος, or definite condition of the substance, τὸ τί); the *efficient* (διοτί, or that *by which* the effect is produced, ἀρχὴ τῆς κινήσεως); and the *final* (οὗ ενεκα, or that *for which* the effect is produced). The three first are clearly three modes of looking *at* the agent; the fourth is a metaphysical mode of transposing an observed result into the position of an originator. "Some writers," says De Morgan, "still talk of final causes, and are as unintelligible to most readers as if they talked of final beginnings." *

* De Morgan: *Formal Logic*, p. 231. It may be worth while to cite the scholastic definition: "Causa finalis non movet secundum suum

55. Since a substance is only cause in so far as it is effective, and the efficiency does not lie in the substance alone, nor in the form alone, nor in both combined, but solely in the *relation* which this formed substance has to some other substance, thereby influencing it, we must, if we would fix on one abstraction, fix on the Efficiens as the determinant; and what that is will in each case depend on the group of relations to be changed, and the Difference which changes it. It is relations, and not substances, that Causation specially involves. Every change in the condition of bodies is a redistribution of pressures. The ribbed sand has the same substance throughout its different forms raised by the wind and scattered by the waves, and each of these forms is the resultant of pressures which are the algebraical sums of the pressures of the molecules. We may, if we please, abstract the relation from its related terms, and call it the *causa efficiens;* but obviously the *efficiens* is only the active aspect of the *materia,* and would vanish with its vanishing related terms.

CAUSE AND WILL.

56. Philosophers, after making this abstraction, have come to a general agreement respecting the impossibility of our knowing efficient causes. Having created the fiction of a disembodied Efficiens, they declared that it could never be perceived. This fiction was further sustained from the side of the First Notion, which identified Causation with Volition. The changes observed in external phenomena were naturally inter-

esse reale, sed secundum esse cognitum."—SUAREZ: *Disput. Metaph.*, xxiii., § 7.

preted by the changes effected through our will. Even to this day, in all the glare of science, the clouds which gather round the conception of Cause are wafted from the mysterious region of Will, and many thinkers hold that no explanation of causation is possible except that which is furnished by volition.

A little consideration will show this to be untenable. The psychological analysis of Volition will occupy us hereafter; but without invoking illumination from that side, we may here place ourselves at the ordinary point of view, and from it see that the identification of Causation with Volition is not acceptable. If we interpret the changes observed in external phenomena as determined by causes similar in nature to those which determine our internal changes and our actions on objects, and suppose that the acid moves towards a base impelled by an "attraction" similar to that which moves the animal to spring upon its prey, or moves us to attend to one rather than another out of many soliciting objects, we may indeed say that in all cases the movement is a resultant of the molecular movements which determine it; but it is quite certain that these molecular movements—these causes—are very different, if only because the effects are different. Whether we assume the Will to be the co-operation of some spiritual agent with the physical agents, nerves and muscles, or assume it to be simply the action of the organism determined by its molecular movements, in either case we have a marked distinction between the agents at work in a volition and the agents at work in a chemical combination. We may name them both "attraction," and regard them both as movements;

but not to recognise the radical unlikeness of the causes in effects so unlike, is to obliterate all distinctions in a uniformity purely verbal. The animal movements which are volitional are accompanied by and guided by Sensibility, which, although interpretable as due to molecular movements in the nerve centres, must be taken into account as co-operating in the production of the effects; and when we say that the animal is "attracted" towards its prey by feelings of scent or sight, which excite desires, and these prompt actions, it is indisputable that we never suppose these feelings operating in the determination of a chemical combination. It is, of course, open to any one to say that, since molecular movements are in both cases the forces or causes in operation, both may be designated by the term Will. But if, with Schopenhauer, he imagines that he has made a great discovery in thus calling different phenomena by the same name, he will soon find that he has only darkened a subject already sufficiently obscure. Even Schopenhauer is obliged to eliminate Consciousness before he can expound his pretended discovery of the Will in Nature. Causation cannot be identified with Volition if Causation is *effectuation*—the coalescence of the forces—since, whatever view we take of the nature of Volition, the volitional act embodies a special group of organic forces, and as such must be distinguished from all inorganic actions.

57. Nor is the case altered if we adopt the spiritualistic conception, which even in inorganic phenomena recognises Force or Cause only as one aspect of Will. Sir John Herschel argues that "all bodies, when raised into the air and quietly abandoned,

descend to the earth's surface in lines perpendicular to it. They are therefore *urged* thereto by a *force or effort*, the direct or indirect result of a *consciousness and a will existing somewhere*, though beyond our power to trace, which force we term gravity." * This is in every way objectionable. It creates the fiction of an Efficiens which is not Materia—a Will apart from all the known conditions—and supposes that the material changes we observe are the products of this immaterial Efficiens. And even then it disregards the speciality of the facts. Unless we mean by cause something wholly unallied to consequent effect, something which is prior to but not procreant of the effect, we can no more assign gravity to will than we can assign the death of a man to the flash of the explosion which preceded it.

* HERSCHEL : *Outlines of Astronomy*, 1849, chap. vii.

CHAPTER III.

THE IDENTITY OF CAUSE AND EFFECT.

58. THROUGHOUT the preceding chapter we have endeavoured to make clear that the terms cause and effect are simply different expressions of identical processes viewed under different aspects. It will now be needful to consider certain objections which may naturally arise in the reader's mind when he thinks of the obvious unlikeness between causes and effects, and of the facts which seem to imply that one and the same cause may have very different effects, and that two or more very different causes may have the same effect.

Nothing is commoner than to hear the same cause assigned to different effects; but in such cases the supposed cause is simply one conspicuous agent in a group of agents, and when it is wrested from this group, and introduced into some other group, the result is necessarily different. It is by no variation in arithmetical laws that because 5 added to 3 yields 8, the addition of 5 to 7 yields 12, and not 8. It is by no variation in causation that a mutton-chop which would have been excellent food an hour ago, will now be an injurious burden to the organism. When we see the same agent, say Electricity, producing differ-

ent effects on skin, tongue, ear, and eye, or on water, gas, and salts, the effects are different because the causes are different, and we are in error in assigning the effects to the single agent Electricity.

59. It was a happy stroke of identification by which Lavoisier saw that Respiration and Combustion were both effects of oxygenation. But although oxygen is an *agent* in both, it is not the sole determinant. Depriving the blood of its oxygen is very similar to depriving the air of its oxygen; and, so far as this agent is concerned, there is a corresponding similarity in the two results—the respiration ceases slowly, and the flame expires Observe, however, the danger of Deduction, when proceeding on such an isolation of one agent as the cause. Since respiration and combustion decrease with diminution of oxygen, it is a natural inference that they would increase with increase of oxygen; and, were oxygen the cause, this inference would be correct. But what says fact? In pure oxygen the flame burns brighter, but the animal expires—that agent which renders the flame intense, renders the animal comatose.

60. If the same cause will produce different effects, different causes will produce the same effect; and this is the popular belief, founded on such facts as that both heat and cold reduce congestion. In ordinary phrase we should say, "Here the same effect results from opposite causes,"—cold lessening the flow of blood by contracting the arteries; and heat facilitating the exit of the blood from the congested region by dilating the arteries.*

* Hence the application of cold is most efficient in the early stages, acting as a *preventive;* and heat in the later stages, acting as a *curative.*

Again, the beating of the heart may be made to cease by irritation of the vagus—by irritation of the nerves of the trunk—by repeated light taps on the stomach—by an emotion of terror or of joy. These various antecedents are, however, not various causes, but various movements which may liberate the energy of one determinant, precisely as the various modes of magnetising an iron rod by rubbing it with a magnet, hammering it in the direction of the magnetic line, or winding an electrical coil round it, are operative through one determinant, which is therefore *one cause* with various accompaniments *not* causal, *i.e.*, not passing into the effect. Asphyxia is an effect which may *succeed* various antecedent events, but *proceeds* only from one cause. The antecedent events may be submersion under water, tying a cord round the neck, vitiation of the atmosphere by overdose of carbonic acid, or by a small dose of carbonic oxide, &c.; but it is not the submersion, the water, the cord, nor the gases which are the efficient causes. The efficient cause, or determinant, is the arrested function of the nerve centres—an arrest due to the prevention of the requisite supply of oxygenated blood. The carbonic acid and the carbonic oxide by their presence prevent the blood being renovated by oxygen; the cord and the water prevent this also.

61. The identity of cause and effect, under their diversity of aspect, is like the identity of the curve under its convex and concave aspects. J. R. Mayer has well said:—"Forces are causes, consequently herein there is a perfect application of the principle: *causa æquat effectum.* If the cause c has the effect e, then is $c = e$; if, again, e is the cause of another

effect, f, then is $e = f$, and so on." * Thus not only does $c = e$, but $c = f$, since $c = e = f$; and reversely $f = c$. If a given cause has produced an effect equal to itself, it has necessarily in that very production ceased to *be* what it *was*, and has passed into what it has *become*. Otherwise there would have been a creation out of nothing; for the cause would still exist as cause, and the effect would have been produced without absorbing the cause; c would not then $= e$. Again, if after the production of the effect there still remained any portion of the cause unabsorbed, there would then be further effects producible by this remaining portion, and thus the total effect of c would be greater than e, which would be a contradiction of $c = e$. "Hence," continues Mayer, "since c becomes e, and e becomes f, &c., we must consider these magnitudes as different phenomenal forms of one and the same object. As the first property of causes is indestructibility, the second property is convertibility, or capability of assuming various forms." But this assumption of various forms must not be understood in the sense of a metamorphosis;—each cause is invariant, but its combining relations are variable. No agent changes itself, it only enters into new relations with others. This is the meaning of the *quantitative indestructibility* and the *qualitative convertibility* of forces and causes.

62. When the case is stated in this abstract form, and the equation of cause and effect is seen to be self-evident, the reader may not only free his mind from all the ancient difficulties respecting the *connection* of cause and effect, the *unlikeness* of effects to their causes, and the *variety* of effects following from the

* MAYER: *Die Mechanik der Wärme*, p. 3.

same cause; but he may also ask how it is that these questions arose to puzzle philosophers? Instead of disputing whether there is any intuitive or demonstrative ground for the belief in a necessary connection (or whether there is any objective validity in the belief), let us consider how it is that, long after philosophers had formulated the truth in such axioms as *causa æquat effectum*, "like causes have like effects," they could still maintain the reality of the logical distinction between cause and effect; and having established the distinction, were forced to invent a mysterious causal link connecting the two?

HUME'S THEORY OF CAUSATION.

63. The chief source of the confusion is the ambiguity of language. No sooner do we express ourselves in the precise and abstract symbols of Mathematics, than the equation, before so obscure, becomes luminous. How manifold are the confusions due to the laxity of ordinary language may be seen even in the writings of the subtle Hume. His essays on Causation are saturated with ambiguities. Throughout he proceeds as if the same causes might, for aught we know, have different effects; he thinks that it is only our habit of expecting the future to resemble the past which generates the belief in a necessary connection. He founds this on two grounds: one, the demonstrable principle that all knowledge of effects or causes is due to experience; the other, the extremely irrelevant assertion that "no object ever discovers by the qualities which appear to the senses either the causes which produced it or the effects which will arise from it"—in other words, no object, viewed in its *present*

condition, is viewed in its *past and future* condition: we see what is visible, we do not see how this came about, nor what will be the new phenomena into which it may merge. "The effect," according to Hume, "is totally different from the cause." If this be so, to say "it never can be discovered *in* it," is to utter a truism. Nature, he thinks, affords us only a superficial knowledge of the qualities of things, but "conceals from us those powers and principles on which the influence of these objects entirely depends. . . . . Our senses inform us of the colour and consistence of bread, but neither sense nor reason can ever inform us of those qualities which fit it for nourishment." Setting aside the fact that Physiology has already advanced very far towards an answer, and will some day completely answer the question respecting the qualities of the bread which fit it for nourishment, let me call attention to the *irrelevancy* of this argument. Did any one ever suppose that it was the colour or consistence of the bread which nourished the organism? And if not these, but something else, is the cause of nourishment, and if this something else is a secret power, our ignorance of it may be admitted; but what has this to do with the relation of cause and effect, which in this case is *not* the relation of colour, consistence, and nourishment, but the relation of the secret power and nourishment?

It is true that the sensible qualities of an object suggest the feelings which formerly were experienced in connection with it; and therefore the colour of the bread leads to the inference that, if eaten, this coloured substance will nourish us; but there is no inference that it is the colour or visible appearances which are

causally related to nourishment. "The bread which I formerly eat nourished me; that is, a body of such sensible qualities was at that time endowed with such secret powers; but does it follow that other bread must also nourish me at another time, and that like sensible qualities must always be attended with the like secret powers?" The answer to this question will depend upon whether the "other bread" stands for something *not* bread, or only for bread of similar nature. In the one case, the "other bread" will have other "secret powers;" in the second case, it will have similar powers, in the exact ratio of its similarity of nature. Hume desires to have the ground of this judgment made plain. He denies, properly enough, that the inference of similar effects from similar causes is made by a chain of reasoning (*no* inference is thus made), and if there be any medium, he declares it passes his comprehension. That we infer the effect, and always act upon such inferences, he admits; but inquires what is this principle of human nature which gives this mighty authority to experience; and he finds it in custom. "It is evident that if this conclusion (of like effects from like causes) were formed by reason, it would be as perfect at first, and upon one instance, as after ever so long a course of experience; but the case is far otherwise. Nothing so like as eggs; yet no one, on account of this appearing similarity, expects the same taste and relish in all of them." The fact is wrongly stated. Because one egg is like another, every mind, on recognising an egg, *re*-cognises what it has formerly cognised of eggs; and, unless in experience there have been marked varieties, the necessary inference on seeing an egg will be that its taste will be

like that of every other. We need no belief that the future will resemble the past, no intuition of Nature's uniformity, no perception of a causal link; we are simply *re*-cognising—that is, ideally reproducing—the feelings which were formerly produced. The physiological foundation of this inference is the connexity of the neural groups, so that when one group is active it excites others, and there is a reproduction in the order of the production. If the order of production has been uniform, the order of reproduction will be so; if some eggs have been sweet and pleasant to scent and taste, and others have been stinking and rancid, this want of uniformity in experience will lead to a corresponding uncertainty of inference; and the influence of custom is not to *found* the belief in like effects from like causes, but to check a too precipitate inference from superficial resemblances; because experience teaches us that objects which are alike in some qualities differ in others.

64. Hume and his adherents gratuitously puzzle themselves with the imaginary connection of two events which are not two events, but two aspects of one. The causes exist only in abstraction until realised in the effect; the agents which are *causal* in one effect may indeed exist in other relations; and it is this which misleads us. The pulses of air may exist without being heard, but they are not sound until they are heard: to consider them as the cause of the sound is simply to suppress the co-operation of the auditory organ, and ascribe the whole effect to one of the agents.

The great and obvious unlikeness of a product to any one of its factors, of the effect to any one of its

causal moments,—an unlikeness which is seen to be necessary,—has led to the fallacy that the product is unlike the combination of its factors, the effect unlike the cause, which is the single term for all the co-operants; and this simply because we select one of the factors to represent the whole, and are also in the habit of regarding the whole of the enumerated factors independently of their combination.

A further peculiarity is to be noted. There are two classes of effects markedly distinguishable as

RESULTANTS AND EMERGENTS.

65. Thus, although each effect is the resultant of its components, the product of its factors, we cannot always trace the steps of the process, so as to see in the product the mode of operation of each factor. In this latter case, I propose to call the effect an emergent. It arises out of the combined agencies, but in a form which does not display the agents in action. Galileo established the luminous principle of the independence of motions. This we may generalise as the independence of causal agents. Each agent, indestructible and independent, has its own individual value; and the effect or combination of agents has two modes: in the one case we have an addition or mixture; in the other, a combination, with an emergent. Thus when we see one motion followed by another, or the depression of one scale followed by the elevation of the other (there is not really a succession, the two are simultaneous, but we consider them successively), we trace such parity in the two events, the one is seen to be so absolutely the equivalent of the other that we seek for no outlying agency, no extra power; the one event is

said to be dependent on the other. We call this a communication of motion; the effect is the motion communicated. Again, in the somewhat more complicated effect of compound motions—say the orbit of a planet,—the resultant of its tangential direction and its direction towards the sun—every student learns that the resultant motion of two impressed forces is the diagonal of those directions which the body *would* take were each force separately applied. Every resultant is either a sum or a difference of the co-operant forces; their sum, when their directions are the same—their difference, when their directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable.

66. It is otherwise with emergents, when, instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds. Add heat to heat, and there is a measurable resultant; but add heat to different substances, and you get various effects, qualitatively unlike: expansion of one, liquefaction of a second, crystallisation of a third, decomposition of a fourth; and when the sensitive nerves of the skin are acted on, the effect is still more dissimilar. Here we have various emergents, simply because in each case there has been a different co-operant; and in most of these cases we are unable to trace the process of coalescence. The emergent is unlike its components in so far as these are incommensurable, and it cannot be reduced either to their sum or their difference. But on the other hand, it is like its components, or, more strictly speaking, it *is* these: nothing can be more like

the coalescence of the components than the emergent which is their coalescence. Unlike as water is to oxygen or hydrogen separately, or to both when uncombined, nothing can be more like water than their combination, which is water. We may be ignorant of the process which each passes through in quitting the gaseous to assume the watery state, but we know with absolute certainty that the water has emerged from this process. To fill up this gap in our knowledge by the word "power," or "causal link," is illusory. Some day, perhaps, we shall be able to express the unseen process in a mathematical formula; till then we must regard the water as an emergent.

67. Were all effects simple resultants, in the sense here specified, our deductive power would be almost absolute; a mathematical expression would include all phenomena. It is precisely because effects are mostly emergents that Deduction is insecure, and Experience is requisite to confirm even the most plausible deductions. Could we by the mere contemplation of phenomena discern the resultants of their changed positions, our deductive vision would be as far-reaching as our ideal construction. Unhappily this is not so. Who, before experiment, could discern nitric acid in nitrogen and oxygen? Who could foresee that gold would be changed into a chloride if plunged into a mixture of two liquids (hydrochloric and nitric acid), in either of which separately it would remain unchanged? Yet it is no extravagant hope that the day will arrive when we shall not only know the separate operations of agents, but their mutual modification in the product which emerges from their union. When an agent, A, has the value x, and another agent, B, has the value y, the re-

sultant of A + B must be $x + y$. But this is only true when no other factor interferes. In truth, some other factor almost always does interfere, though it is generally thrown out of the calculation, either because it is arbitrarily set aside, being irrelevant to the purpose in view, or too small in amount to disturb our "approximation." So that, strictly speaking, the *real* effect is always an emergent, since we never know with absolute accuracy enough of all the factors to trace their operation. This, which is true of reals, is no longer true of ideal constructions, wherein the factors are accurately defined.

68. Either as resultants or emergents, we know the causes in knowing the effects: how much we know is another question. Kant tried to prove that Causation had no objective reality, but was simply the reflex of Causality, a subjective category, according to which phenomena are classified. This argument rests on two assumptions, which I think inadmissible: first, that we do not know things in themselves; and secondly, that the categories are not evolved in the evolution of the organism through its relations to the medium, but pre-exist, and render evolution possible. Kant answers Hume's scepticism by declaring that our belief in necessary connection is a necessity of thought, not of things. Hegel more profoundly said that it is a necessity of thought because it is a necessity of things: "the effect is necessary just because it is the manifestation of the cause, or is this necessity which the cause is."*

69. In the whole range of Speculation there is no

* Hegel: *Logik*, ii. 218. See the whole paragraph, too long for extract here.

idea which has been more misleading than the idea of the effect being unlike its cause. On it rests the statement—by so many taken for an axiom—that we can know nothing whatever of things and causes; our feelings being simply the effects things produce in us. The Reasoned Realism of this work rests on the counter-statement that causes are known in effects, and things are known in their qualities, which are our feelings. "The rhythmic pulses of the air we only know as sensations of sound, or as waves in an elastic medium; what they are in themselves we do not know, we only know that they must be unlike auditory feelings, because effects are unlike their causes." Such is the reasoning advanced in a hundred works. Let us answer it indirectly. The rhythmic pulses of the air, impinging on the tympanum, precede the sensation of sound; in this relation the aerial pulses are known. Impinging on the tongue or the lining membrane of the nose, what effect do they produce? We do not know. Some effect they must produce; but *what* effect is not suspected, probably will never be known. Are we then to allow our ignorance of the aerial pulses in this relation to disturb our knowledge of them in their relation to the auditory sense? Because we do not know something *else*, are we ignorant of *this?* The aerial pulses *are* to the auditory sense one causal agent of the effect, sound. Can anything be more gratuitous than to say, we do not know what aerial pulses are, we only know their effects on our auditory organ? In this specified relation they are nothing else. To know anything is to know how it affects sense, not how it will affect something else which we do not know. The object out of relation to sense is an abstraction.

The real object is that which is; and, as I often say, a thing *is* what it *does*: it is to us what it is felt to be.

70. A bell is set vibrating, and these vibrations transmitted through the air reach an auditory apparatus, and the product is sound. Science having thus discovered the aerial pulses to be the antecedent of sound, and antecedent being taken as cause (the auditory apparatus, being presupposed, is not specified as co-operating), psychologists ask, What likeness is there between this cause and this effect? Likeness there is none; but I add, Causation there is none. One of the causal elements alone does not suffice. Ask what this supposed cause really is, and you will find that the air and its pulses, which figure in your mind, are simply products of the co-operation of the objective factor with several subjective factors. The air, you say, is a substance having elasticity, weight, mobility, &c., and its motion is a pendulum vibration of its particles, which is mathematically represented in the form of waves that are the envelopes of the partial waves formed by the vibrating particles. This air in its wavelike motion is the objective cause, you say, of sound. I deny it altogether. I say, *this* air, *this* object, is the form of your sensible affections when this external agent is in relation to the corresponding senses. All the qualities you enumerate as belonging to the air are the feelings which the agent produces in co-operation with your various sensibilities. The air *is* such in each relation; but *these visual relations are not the same as its relation to your auditory sense*; and to suppose that *they* cause the sound is an error. It is not the visible and tangible that is audible; the visible is visible, and the audible is audible; in both

cases there is a causal relation between object and subject, and in both cases the effects are different, since the relations are different. When the aerial pulses are said to be the cause of sound, the correct interpretation is, That objective factor which, combined with the senses, Sight and Touch, is an agent in the production of visible and tangible feelings, combined with the sense of Hearing, is an agent in the production of audible feelings.

71. And this is the interpretation we must put on the conception of our sensations as signs or symbols of objects. Not that each feeling is a sign of its objective factor, but a sign of the other feelings which experience has associated with it. Helmholtz and Spencer, relying on the assumed unlikeness of effects to their causes, regard our perceptions simply in the light of signs of unknowable objects. Is not this answered by what has just been said? A sensation is a sign of other sensations, but it *is* the relation of the object felt to the feeling. When, seeing a coloured form, I infer that if I stretch out my hand this coloured form will be a touched form, because these two feelings have formerly been experienced in close connection, this visual feeling is indeed a sign of the tactual feeling, the sign from which the inference is inferred; but assuredly the feeling itself is no *sign* of what is thus felt. My inference of the tactual feeling may be right or wrong, the feeling may or may not follow my outstretched hand; and the sign will thus have been a true or false sign. But my visual feeling is of the object itself in that special relation, not a sign of it. The feeling as an effect is constituted by the two factors, object and subject; these are the related terms,

and the feeling is the relation or coalescence of these terms. Therefore to say that we do not know the objects, but only the feelings they excite in us, is simply saying that we do not know what objects are in other relations than those of feeling—a truism which is quite irrelevant, but a truism on which metaphysicians have erected the idle mystery of the *Ding an sich.*

72. This mystery will occupy us in the next Problem. Here it is referred to because I foresee that metaphysical readers will be greatly dissatisfied with the solution of the problem of Causation given in the foregoing pages, on the ground that it leaves untouched the question so dear to Metempirics, What is cause in itself, apart from its effects? According to the principles of this work, the only possible solutions of problems are those which express the facts of Experience; and the only demand that can legitimately be made is, that no experiences be contradicted; the solutions will then be more and more complete in proportion to the completeness with which they express the known. The unknowable they do not pretend to express. Yet it is precisely this unknowable which so many seek. Cause to them means what the German word indicates, primal existence—*Ur-sache;* not the *Sache*, or thing, now felt, now existing; but the thing which preceded it and other things. And this desire is sustained by the very principle of investigation, which always seeks the antecedents of an event. Science classifies phenomena under heads that are more and more general, hoping finally to reduce them all to one comprehensive formula. No one will deny the immense utility of this aim; but we must

not suppose that even were the aim fully realised it would bring us nearer to a knowledge of things than we were before; it would only classify that knowledge.

Let us take, by way of illustration, the theoretic reduction of all the phenomena of musical sound to the one cause, Vibration. We know that there are various musical instruments, each of which has its peculiar *timbre:* the stringed instruments differ from those of brass, these again from the reeds, and all from the human voice; but throughout these differences there are resemblances; and there is one effect common to all, one physical condition therefore common to all. This one effect is musical feeling; this one physical condition is vibration. It may be said that in Vibration we have the primary cause, the *Ur-sache*, the generator of all the different effects. Nor need we allow ourselves to be disturbed by the metaphysical difficulty that Vibration itself requires a cause, something prior to air, something prior even to Motion. Let us accept the Vibration as our ultimate, and take it analogically to represent the Primal Existence, the Cause of Causes. Then I say, firstly, we need also Sensibility to give Vibration its specific quality of Tone; secondly, even these are insufficient, and for this reason: they are the abstract expression of that which is *common* to all musical sounds, but leave unexpressed all that is *special* to each. They are not the real causes of any one tone. We know that each tone depends on special conditions: the length of the string, its thickness, its tension, the nature of the applied force, whether the sweep of a bow or the pinch of a finger, &c.; all these are factors in the product, all therefore are causal.

73. And so with the varied phenomena of Nature. Each has its special conditions which individualise it, and make it what it is. The general resemblances of phenomena which we detach as Laws are facts no less certain than the manifold diversities; but they are abstract facts, which are realised only in concrete phenomena; and to suppose that they are the determinants of phenomena is an illusion.

Hence we conclude, firstly, that we do not and cannot know the *Ur-sache*—the Primal Cause, the Cause which is not effect; cannot know it, if only because we were not present at the origin of things. Nay, could we know it the knowledge would be useless, since what we are concerned with is *actual* Existence, not Existence in its *undetermined* state. When we know the tones of the various instruments, and the special conditions of their production, a knowledge of the Laws of Vibration will enable us to classify and elucidate the phenomena; but no abstract knowledge of Vibration will enable us to hear the various tones.

74. Finally, let me say that the search after causes is the search after the special conditions which enter into and compose the effects, and not the idle search for *something else.* A phenomenon is a *process;* its *causation* is its *procession;* and this may be viewed analytically in its component causes, conditions, and synthetically in the resultant effect.

The one constant burden of my remarks is that of recalling Speculation from the futile phantom-search, which disregards what is plainly given in Experience, and desires something not to be found there. If Science necessarily looks beyond and away from the present fact in search of its determining

factors, it must also connect in a synthesis what it separates in analysis; and having found the factors, must see them passing into and determining the product. In life, it is the present moment, the present fact, which is important; the moments which preceded, the facts which went before it, borrow all their interest from their relation to it. The mind, indeed, must "look before and after," but it stands upon the "now" and the "fact" with which it has to deal. We are but too apt, in our impatience, to neglect the present moment, casting lingering glances backward on the days that are gone, and longing glances forward to the days that are to come, as if the former had not been, and the latter will not be, simple presents. We fail thus to enjoy the present, and to estimate the event or the man that is with us; we let the irrecoverable opportunity slip by, to regret it when it is gone. We are always going to reform our habits, and beautify our lives. We put off needful labour for a time of leisure, and when that time comes, it is fully occupied with petty solicitations. We are drawn away from the sufferings or the needs of those immediately near us, thinking it a greater work to give all our efforts to lessen the evils pressing on those who are distant and unknown. We neglect the strenuous duties of this daily life in favour of a barren contemplation of a future. In Practice, as in Philosophy, the great lesson to be learned is not to separate the real from the ideal, not to sacrifice the one to the other, but to recognise the ideal in the real, and blend the two in one.

PROBLEM VI.

THE ABSOLUTE
IN THE CORRELATIONS OF FEELING AND MOTION.

"Le forme dei fenomeni, studiate nelle loro somiglianze, hanno lascito vedere, al dissotto di sè, una forma fondamentale unica, che le genera tutte, per quanto varie all' infinito, colla sempliee sua reduplicazione. Dallo studio dei fenomeni co-existente risultò, che gli esseri in apparenza più diversi ed opposti costituiscono un ordine unico di cose. Ed un congegno unico di forze, malgrado la disformità e contrarietà apparente, si manifestò pure dallo studio delle successioni dei fenomeni dovunque e comunque osservate. Di quì, e solo di quì, il filosofo positivo trasse la sua conclusione, che tanto il mondo della materia quanto quello del pensiero si comprendono nello stesso concetto della natura, sia che vi si consideri la forma dell' essere, o l'ordine delle cose, o il congegno delle forze."

ARDIGÒ: *La Psicologia come scienza positiva*, Milano, 1870, p. 398.

"Wenn Jemand innerhalb eines Kreises steht so liegt dessen convexe Seite für ihn ganz verborgen unter der concaven Decke; wenn er ausserhalb steht liegt umgekehrt die concave Seite unter der convexen Decke. Beide Seiten gehören ebenso untrennbar zusammen als die geistige und leibliche Seite des Menschen, und diese lassen sich vergleichsweise auch als innere und äussere Seite fassen; es ist aber ebenso unmöglich, von einem Standpunkte in der Ebene des Kreises beide Seiten des Kreises zugleich zu erblicken, als von einem Standpunkte im Gebiete der menschlichen Existenz diese beide Seiten des Menschen."

FECHNER: *Elemente der Psychophysik*, 1860, i. p. 2.

"Hic sine dubio lectores hærebunt, multaque comminiscentur quæ moram injiciant; et hac causa ipsos rogo, ut lento gradu mecum pergant, nec de his judicium ferant donec omnia perlegerint."

SPINOZA: *Ethices*, Pars ii., prop. xi. schol.

THE ABSOLUTE IN THE CORRELATIONS OF FEELING AND MOTION.

CHAPTER I.

THE PROBLEM STATED.

1. THAT man can never know the Absolute, is nowadays the reigning dogma of Philosophy; and many readers will suspect me of wilful paradox in asserting that our knowledge of the Absolute, so far from being hopeless, is wide, varied, and exact. In saying this, I must of course be understood to restrict the conception within the limits of empirical research, and not to recognise that metempirical conception of the Absolute which detaches it as a Supra-sensible from all sensible experience. Nor can such a restriction be fairly objected to, since the Method of this work imposes it. If by the Absolute is meant the Unconditioned (a shadowy meaning, intelligible only as the abstract Nought), there is an absurdity in asking whether its conditions are knowable. If by the Absolute is meant the Unfelt, then as the Unthinkable it is assuredly unknowable. But not with these shadows are we concerned.

Hamilton could say, and others repeat, that "the

Absolute and Infinite are two counter imbecilities of thought, subjective necessities transformed into objective necessities." And in their meaning of the terms this may very well be. But must we accept their meaning? Must we imitate them, and separate the abstract term from its concrete significates, which are its real elements, but which they call its *manifestations*, and suppose to be something different? And, having effected this imaginary separation, must we say that since all knowledge is of the manifestations only, and not of *that* which is manifested, we can never hope to know the Absolute? This is by no means certain. No one doubts that if the Absolute is this mere postulate it is unknowable, for it is postulated as lying outside the manifestations which can be known. But we should like to have very clear evidence that it is such a postulate.

2. Precision of meaning is the first requisite here. Nothing can be easier than to show how impossible it is for a knowledge which is relative to transcend its relativity and embrace the Absolute; nor easier, on the other hand, to show how, absolute and relative being correlative terms, the one cannot be known without the other: the two abstractions are not incongruous, but inclusive. Then, again, a ready acceptance is gained for the proposition, "The finite can never comprehend the infinite." But since, as a matter of fact, somehow or other, the mind does very accurately comprehend the infinite, dealing with it as with all other abstractions, we are called upon to reconcile these contradictions; and this reconciliation is possible when we come to give precision to our terms.

3. Let us first consider the Infinite: There is a recognised tendency in Speculation to sensualise Thought, by personifying abstractions;—this is the inverse of the tendency to intellectualise Sensation by transforming it into abstractions. It is this tendency which has originated the conception of *an* Infinite, viewing it as a Real; analogous to the conception of *a* Motion apart from moving bodies. The Infinite, being without limits, is contrasted with finite Reals, which are limited. Philosophers, having converted ideal distinctions into real separations, then ask: How can the human mind, which is limited, pretend to embrace the unlimited? But the question is improperly put, and conceals an assumption not to be granted. Nothing can be said against the proposition, "The finite cannot comprehend the infinite," for it is a truism; but when this is made to carry the further proposition, "The human mind cannot comprehend the infinite because it is finite," my dissent fastens on that last clause, and I ask: How, if on examination, the human mind should turn out *not* to be finite?

4. This question is no overdrawn subtlety, no quibble, but a serious question, intimately connected with the conception of the Infinite, which is a symbol only met with in the Logic of Signs, although its significates are given in the Logic of Feeling. Of what is it a symbol? Not of Quantity, as commonly, and with much confusion, supposed; but of an *operation on* Quantity.

Among the fundamental Signatures of Feeling there is the one named Magnitude, or Muchness—the more or less of Quality. There are three kinds of Magni-

tude—intensive, extensive, and numerical. The first of these is not, rigorously speaking, measurable, since it only admits of the inequality of More or Less, and does not admit of equality or ratio. The second is continuous magnitude; the third is discrete magnitude. These two last, being measurable, are quantities in the strict sense: by them we specify the *how muchness.*

Quantities, or measurable magnitudes, are either definite or indefinite. A definite magnitude is one which has *assigned* limits; an indefinite magnitude, one which has limits *assignable* but *not assigned.* Thus a circle of three inches in diameter is a definite magnitude; a mountain, or a crowd of men, is an indefinite magnitude, the limits of which could accurately be assigned if we took the trouble.

5. The Infinite is often confounded with the Indefinite, but the two conceptions are diametrically opposed. Instead of being a quantity with unassigned yet assignable limits, the Infinite is not a quantity at all, since it neither admits of augmentation nor diminution, having no assignable limits; it is the operation of continuously *withdrawing* any limits that may have been assigned;—the endless addition of new quantities to the old:—the flux of continuity. The Infinite is no more a quantity than Zero is a quantity. If Zero is the sign of a vanished quantity, the Infinite is the sign of that continuity of Existence which has been ideally divided into discrete parts in the affixing of limits. Hence it is that although for our purposes we divide Space and Time into spaces and times with definite limits, we conceive both Space and Time as infinite; and are forced to do so, because

Beyond each limit the flux of Feeling continuously passes into other spaces and times. We cannot have a feeling of space or time which does not irresistibly overflow any assigned limit. Spaces continuously added to spaces, generate this idea of infinite space.

6. This premised, we may now turn to the question whether Mind is finite? If we regard it as a Magnitude, it must be an intensive magnitude, which admits of no measurement; it is conceived as movement. Now, because Feeling is in a constant flux, one feeling succeeding and blending with another, and Thought is ever moving into new forms, shifting its limits, Mind, as the symbol of all Feeling and Thought, is the very type of that ceaseless flow which is designated by the Infinite. And because it is so, the conception of an objective Infinite arises; and the term, when translated into experience, expresses the fact of continuity of Existence underlying all discreteness of quantitative division.

7. Waiving this, however, and falling back into the ordinary track of conceptions, I dispute the assertion that man cannot comprehend the Infinite; an assertion which usually relies on the incorrect notion of Thought being restricted to Imagination. That of which we can form no image is often said to be unthinkable; but this is to mistake the very nature of conceptions as symbols. "Certaines personnes," says Descartes, "sont tellement accoutumées à ne rien considérer qu'en l'imaginant, ce qui est une façon particulière de penser pour les choses matérielles, que tout ce qui n'est pas imaginable leur semble n'être pas intelligible."* The fact that we have the conception of the

* DESCARTES: *Discours sur la Méthode.*

Infinite is indisputable, let its genesis be explained how it may. That we comprehend it is certain, since it is an idea which we employ with rigorous precision. We comprehend it as an operation. We comprehend it as we comprehend other abstract symbols. So that if the reader rejects my suggestion of its being not a quantity, but an operation on quantity, and if he declares it to be a symbol of the total Reality, the One Existent, he must still admit that it is comprehended as an abstract symbol, and that he knows Existence in knowing concrete existents. That we do not, cannot know all existents, is obvious. That we cannot know Existence *in itself*, out of all relation, is also certain. But does it exist in itself? and who knows this?

8. Setting aside this ancient difficulty respecting the Infinite, let us consider the other conception of the Absolute, which symbolises the Universe or Living Whole, some parts of which are the known and knowable phenomena of our Cosmos. To say that we do not, cannot know all Existence, or all modes of Existence, is indisputable, but idle. We certainly know concrete existences, and also know the abstraction (Existence) by which we condense these in a symbol. The contention of those who declare the Absolute to be unknowable is, that beyond the sphere of knowable phenomena there is an Existent, which partially *appears* in the phenomena, but *is* something wholly removed from them, and in no way cognisable by us. This may be so; but we can never know that it is so. In any case, it is supremely indifferent to us, and nothing but the very wantonness of Speculation could lead men to occupy themselves with it. Yet, since

Speculation has long occupied itself with the imaginary Noumena "impenetrably hidden behind Phenomena," and since these Noumena have been regarded as the veritable Reals, we may attempt a decisive discussion of the evidence on which this opinion rests. Clearly, if nothing can be known of Existence as it really is, only of its shadowy manifestation, the Absolute is altogether unknowable.

CHAPTER II.

THINGS IN THEIR ATTRIBUTES AND IN THEMSELVES.

9. KNOWLEDGE, in all its manifold varieties, is classification of virtual feelings. The feelings classified were distinguished among themselves by the unlikeness in their conditions, and grouped by the likeness in their conditions. Each was a product of like and unlike elements, for identity and diversity are the inseparable aspects of all feelings. We logically distinguish what we know to be incapable of real separation; and thus, according to our point of view, we regard things under one or the other aspect, according to the needs of the occasion. Science, which is the *system* of classified resemblances and differences, has thus two varying directions; 1°, the *practical*, which deals with the established classifications, accepting the distinctions useful for its immediate ends; and 2°, the *theoretical*, which seeks to unite the differences in some higher unity, classifying them according to their resemblances, and thus obliterating all those distinctions which are particular, and have no general significance. Of course the two tendencies converge and co-operate, but we may here consider each for itself. They converge and co-operate, for example, in Biology, although any individual biologist may

chiefly follow one or the other. He may be an anatomist, dealing with the organism as a completed structure: he then describes each organ, each tissue, each element as he finds it, and explains the connections of the parts. From his point of view the distinction between nerve and muscle is capital; only anatomical inexperience could confound them, or assign the special characters of the one to the other. He sees and enumerates the differences between epidermis, crystalline lens, nails, hair, teeth, &c. His science, and the medical art founded on that science, depend on such distinctions being accurately noted. But another biologist, or this same one on another occasion, having to consider the organism from the point of view of Development, sets aside all these well-marked differences to pursue the accompanying *masked* resemblances. Dealing with the evolution of the organism, he shows how it became what it is: points out that nerve and muscle are identical in essential characters, and that epidermis, lens, nails, hair, teeth, &c., are but differentiations of one tissue. Not stopping here, he shows how the manifold varieties of the complex organism arise by successive differentiations from the homogeneous germinal membrane. His Analysis, going backward far enough, finds all the diversities of organic structure merged in identity; while, advancing forwards, Synthesis finds the primitive identity disappearing more and more in diversity. The structureless protoplasm and the complex organism are thus contrasted or identified, according to the point of view of concrete Observation, or of abstract Theory.

10. Here the question arises: Is either view to

be accepted as that which alone represents the truth? Is the practical or the theoretical conclusion to be preferred? The principles of one school of philosophers would imply that the organism known in all its complex appearances is not the Real, but is simply a phenomenal transition stage of the deeper Real which does not appear; each differentiation noted by the morphologist has, underlying it, a substance *of* which it is the differentiation; and this never appears in its own reality; all the visible diversities play over the surface of an invisible identity, which is the only Reality, because it only is permanent. The principles of the antagonist school imply that this invisible identity is an abstraction formed out of concrete phenomena, and then imagined to underlie them: it is not real, but ideal; the organism is the real.

We shall see presently in how far both these conclusions fall short of empirical justification. First, however, note this same twofold direction of inquiry in the great problem of Metaphysics. Here also the differences and antitheses which get established in experience are set aside, or brought prominently forward, according to the point of view. Here also Thought integrates what Sense differentiates. The intellect, having classified and distinguished, comes to accept its classifications and distinctions as reals. For example, the marked distinction between Object and Subject, Matter and Mind, Things and Thought, is unhesitatingly accepted by the practical intellect, which has to deal with established distinctions, since it operates on what lies ready to hand, instead of perplexing itself with what is *not* there. It deals with the actual products, not with the factors, real or

imaginary, and calls objects by their assigned names, estimating symbols by their conventional values, so that to it the antithesis between Things and Thoughts is absolute. Not so the theoretical intellect, which is looking away from the actually *there*, seeking *how it came there*—overlooking the product in the search after its factors; for it, the marked antithesis is no longer absolute, but Things are inseparably blended with Thoughts. Thus the one point of view regards things as if they had no history, and would have no future; takes them for what they are worth at the moment, and for the particular purpose. In truth, Things exist just so long as their conditions exist, whether that be a moment or a cycle. The practical intellect deals with the *now* and *here*, and cannot determine its present action by what *has been*, or *may be there*. This is the working spirit of the world. We call it Common Sense in the ordinary affairs of life; Experimental Science in affairs of intelligence. It is the intuitive gaze *at* phenomena, not the discursive sweep *round* and *over* them. All its security would vanish if its useful landmarks were obliterated; all scientific practice would tumble into chaos if this firm hold of Difference were loosened and Identity allowed to take its place. But the theoretical intellect, not being called upon to act, is free to reflect, and "with large discourse of reason" sweeps round the circle of Possibility, reconstructs the past, and prefigures the future. To it, established distinctions are but passing waves in the universal flow of Existence; and it points to the fluent identity throughout the manifold diversity. Its aim is to unify knowledge; and this can only be effected by setting aside diversities.

11. The theoretic intellect in its normal operation converts its own distinctions into *objects*, and supplies each object with a logical subject. We have seen what this logical Subject is—namely, the group of predicates. It has its corresponding conception in Substance, or group of attributes. That is to say, what the logical subject and physical substance severally represent is the unity which groups certain various particulars; and no sooner is the group as unity distinguished from the particulars grouped, and thus made an object of Thought, than the operation of supplying *it* with a subject is inevitably performed, and the group becomes *substantialised*. This is the genesis of our conception of the Thing in itself as the unknowable Real, which is said to be a necessary postulate, although nothing more can be known of it than *that* it is, not *what* it is.

12. Metaphysicians commonly regard the belief of ordinary men in the real existence of the objects seen and touched to be the natural illusion of Sense. I regard their postulate of a deeper unknowable real to be the natural illusion of Speculation substantialising its abstractions. If ordinary men fail to see the inseparable unity of things and feelings, and hold the logical distinction of aspects to represent a real separation of existents, the metaphysicians commonly fail to see that their abstraction, "Thing in itself," is only a product of the logical operation. Ask a man what anything is, and he will describe all the characteristics which it is known (or supposed) to combine, all the ways in which it acts on him and on other things. Ask him, What more is it? and he will be silent, unless he is a metaphysician, in which case he

will reply: "Over and above these known and knowable characteristics there is something which constitutes the Thing *in itself*—its quality as a force—one item in the sum of unknowable forces." If asked, How he knows this? He can only refer to it as a necessary postulate. But on examination this postulate turns out to be simply due to the tendency of the mind to substantialise abstractions: a tendency which is strengthened by the necessities of logical distinction.

Thus, suppose we take sulphuric acid and describe its properties, we may not deny that it *is* what it now manifests, because under *other* conditions the manifestations will be other. The chemist, who assures us that it is a combination of sulphur and oxygen, tells us something of what will be the manifestations of this acid when it is decomposed, *i.e.*, when it ceases to exist as acid. These elements, oxygen and sulphur, are admitted to be capable of manifesting very different properties under different conditions; but we do not doubt that, under specified conditions, each element is what it manifests. The abstract possibility of other combinations of conditions is no disproof of the reality of present existence. The fallacy of a Noumenon consists in assigning reality to this abstract possibility.

13. The ordinary distinction of Things and Feelings (in which Thing expressly stands for what is not Feeling), gives a certain validity to the idea of a Thing in itself existing quite apart from Feeling. Nor is this disturbed by the psychological teaching which shows the inseparable blending of the two; and that we cannot speak of a thing at all except in terms

of Feeling, cannot imagine an *ens* except in relation to a *sentiens*. The unfelt Object is an abstraction from which the necessary co-operation of the Subject is eliminated. No reflecting man believes that Virtue, Wealth, Strength, Truth, &c., are existents *apart* from the Mind which conceives them; yet most men believe that other abstractions, *e.g.*, Matter, Force, Cause, Law, Quantity, &c., exist *as such* irrespective of Mind. Hence it may sound like an extreme paradox to say that Things have not separate existence apart from Feelings; but it is a paradox which must be accepted, when we consider that things are what they are in the given relations; and that in relation to the sensitive organism the so-called "thing" is what is present in Feeling. This is not a denial of the objective factor—the non-ego. It does not assert that the stone lying on the ground is not somewhat more than the feelings of it in you and me; all that is asserted is, that the "somewhat" in *this* relation *is* what it is felt to be; and if I am asked what this postulated "somewhat" is, if not the metaphysical Thing in itself? I answer: The "somewhat" is the abstract possibility of one factor of a product entering into relation with some different factors, when it will exist under another form. Oxygen when combined with sulphur *is* not anything which it *may be* in *other* combinations. The objective factor, which is stone, when in one relation to sense, may be, *must* be, something else in another relation.

14. The "Thing in itself" is a fiction founded on a convenient distinction. We are said to consider a "thing in itself" when we refer to its appearance under present conditions, but make no reference to

those conditions, or when we limit its sensible aspects. If we describe the constituents of a salt, and its geometric form, we describe what the salt is "in itself," without reference to its action on other bodies, or its relation to surrounding bodies, although Reflection assures us that the salt is what it is precisely because of these unemphasised conditions. Although we make no reference to the surrounding temperature, we know that a slight variation in that temperature will destroy the geometrical form, and convert the salt into a solution; a still further variation will destroy the saline composition, converting the solution into gases; but the salt is considered solely in itself, in its enumerated qualities. Again, we consider a man in his individual characteristics, and disregard his relations as citizen, soldier, statesman, husband, parent, or son. Obviously in this sense we know things in themselves. But upon this the metaphysician founds a very different conception. His "thing in itself" is an imaginary thing abstracted from *all* relations. This is, *ex vi termini*, unknowable. But even if the existence of such a thing be granted, on what grounds are we to conclude that it is the absolute reality?

Its existence is not to be granted. It is a fiction, and we know its genesis. Kant invented a Pure Intuition to serve as the *à priori* condition of Empirical Intuition, and Pure Understanding as the *à priori* condition of Empirical Conceptions; he was also led to invent a Pure Object—(the *Ding an sich*)—as the *à priori* condition of Empirical Phenomena; thereby giving precision to the abstraction which metaphysicians had substantialised and declared to be the per-

manent Reality underlying fleeting Appearance. This metempirical duplicate of empirical facts may easily be recognised to be a logical fiction. Phenomena exist, but it is impossible to deduce their manifold variety from the postulate of a Noumenon in its formless monotony; whereas we can well understand the genesis of the abstraction Noumenon from the concrete Phenomena, as the symbol of what is common to them all. Having repeatedly observed each group of sensibles displaying fresh qualities under new conditions, we come to regard each object as a fountain of possible appearances. The red thing is found to be also a sweet thing, also a soft thing, also a fermenting thing, and so on. We abstract this *Also*, personify it, assign it an imaginary substance, and assume that the Possibility is a Reality apart from all conditions.

15. Von Martius once told me that the uncivilised races of the Brazils, among whom he had lived, had a distinct idea of the blowing wind which they felt, but no idea whatever of the invisible quiet air which they did not perceive. The metaphysician may urge that we are in an analogous position with respect to the Noumenon. Phenomena we name because we perceive them; Noumena lying outside feeling can only be conceived by a process similar to that which admits the existence of the invisible air. The argument is valueless. The Indian knows nothing of the invisible air; but we can demonstrate its existence by bringing it within the range of Feeling; we can condense it, decompose it, render it tangible and visible. And if the metaphysician would prove the reality of the Noumenon *apart* from its phenomenal manifestations, he also must withdraw it from the invisible

intangible region—that is to say, he must make it phenomenal. Metaphysicians consider it deplorably superficial to accept the appearances of things for realities; but Science and Common Sense will declare it to be utterly irrational to assume the reality to be that which cannot appear. The thing is its attributes; that is what we have to deal with, what the thing is to us.

16. When metaphysicians tell us that we can never know things in themselves, and therefore all knowledge of the Absolute is necessarily excluded, our reply must be, that, in any rational sense of the terms, things *are* known; and if the Absolute is the sum of things, then this Absolute is known, both in the known concretes, and in the abstraction framed from them. It is, of course, a necessary consequence of the relativity of knowledge that we can never hope to attain finality, never completely exhaust the possibilities of Reality; but it is not less a necessary consequence that knowledge, so far as it goes, is certain, absolute, not to be rendered illusory by its limitations. One truth is not the less certain because other truths may some day be known which will embrace it. One ascertained relation between two events is not the less reliable as a guide in Action because other relations are unascertained. The astronomer, we are told, can explain the movements of the heavenly bodies by the law of Gravitation, but is wholly ignorant of what Gravitation is. I say the astronomer knows what Gravitation is, when he knows it as the abstract expression of the observed facts: he knows Gravitation if he knows the gravity-relations of bodies, since it is these relations which are symbolised in the term.

The objection assumes that the astronomer, besides knowing the facts expressed by the symbol, ought also to know an indefinite mass of *other* facts, which would require another symbol. It is as if we said that a man who has lived in Brittany, traversed it from end to end, examined its soil, its climate, its produce, its history, has no knowledge of this part of France, because he knows little of Normandy, less of Burgundy, knows only the names of Timbuctoo and Sumatra, and never heard of Yucatan. An extension of his knowledge in these directions might enable him to classify and interpret his Breton experiences to better effect; but obviously his ignorance of outlying lands cannot make his knowledge of Brittany unreal.

17. In a word, the "thing in itself" is a metaphysical fetich. It replaces the old conception of Essence, which had replaced the earlier conception of a spirit, or demon, living in the object, animating it, and working by it. The savage regards his fetich in the light of a vehicle for the spirit which acts through it; the metaphysician regards the phenomenal object in the light of a vehicle for the manifestations of a Noumenon which shines through it. The Unknowable Absolute is the monotheistic development of this fetichism —the generalisation and unification of all the particular entities or noumena. This we may now consider.

CHAPTER III.

THE ABSOLUTE AS UNKNOWABLE FORCE.

18. To hold that man cannot know the reality which underlies phenomena, and therefore can never know the Absolute, which he is nevertheless compelled to believe in, is to hold an opinion which scarcely admits of question when the terms in which it is expressed are clearly defined; but it is an opinion vehemently rejected by men who refuse to acknowledge that the terms so defined express any positive experiences. These objectors maintain that, according to the only rational serviceable meaning of the terms Things, Reality, and Absolute, man can and does know them, if he knows anything at all. It is obvious that the antagonist schools are not standing on common ground.

Note, moreover, that the Agnostics belong to very different schools. Kant in Germany, and Comte in France, Balmes in Spain, and Gioberti in Italy, Hamilton in Scotland, and Spencer in England, however much they may differ on other points, agree in this. Such unanimity in nescience, with such diversity in science, would carry overwhelming weight, did we not see—or fancy we saw—the equivoque and the

fallacy which are common to all these modes of conceiving the question. Now, it appears to me that both the equivoque and the fallacy have been exhibited in the foregoing pages. The equivoque is that of using the terms—Thing, Reality, Absolute—to mean what is not given in Experience, but is simply postulated to explain Experience. The fallacy is that of confounding a logical distinction with an actual separation, and hence assuming that Reality is essentially different from its Manifestations.

19. If Existence, Reality, is altogether unknowable, by what right can any one affirm that it is different from, and separated from, manifested existences or things? When we assert that the shadow thrown by a solid is not itself solid, we do so on the evidence which solid and shadow severally display. Does any one pretend to know the Reality apart from its Manifestations, so that he can point out its difference? No one pretends this. In the *Mécanique Celeste*, Laplace, speaking of Inertia and Force as proportional to Velocity, says, "these are the most natural and simple laws that can be conceived;" which means that they are the expressions of observed facts, and no simpler expressions can be *conceived*, because no other sequences have been *perceived*. Instead of thus limiting his statement, however, Laplace adds, "they are derivations from the nature of Matter itself; *but this nature being unknown*, the laws are for us nothing but observed facts."* Is it not strange that he should in one breath declare the laws to be derivations from the nature of Matter, and declare that nature to be *unknown*? How could he justify

* LAPLACE: *Mécanique Celeste*, Paris, An. viii. i. 18.

this assignment of the laws observed to any unknown nature? What was probably in his mind was, that although these manifestations of Matter were known, and constituted indeed our knowledge of Matter (its nature) under these conditions, yet, were it observable under *other* conditions, it would present very different manifestations, which, however, are at present necessarily unknown. But here, once more, the question must be asked, Why assume that what is known is not real, and that only the unknown or unknowable is the real?

20. Instead of swelling this chapter by an examination of the arguments urged from various sides against our knowledge of the real nature of things, it may be well to confine ourselves to those urged by Mr Herbert Spencer, the latest, and assuredly one of the most important, of the Agnostics. On so many fundamental points I agree with his teaching, that it is not without diffidence and regret that I find myself unable to follow him in that theory of Transfigured Realism, which is the foundation of his theory of the Unknowable. He has argued with his usual force that the Absolute is given in Consciousness, cannot be banished from it, but is ever present in the abiding antithesis of object and subject. He has shown that the very conception of the Relative is inseparable from its correlative Absolute; that "Being in itself out of relation is unthinkable, as not admitting of being brought within the form of thought." But having, when arguing against idealistic theories, taken up this decided position, he afterwards makes what seems a sudden *volte face*, and proceeds to show that this Absolute given in Consciousness, and forming the very life-blood of

Thought, is nevertheless utterly unknowable, unthinkable, not to be apprehended even in the dimmest way. It is a transcendental postulate, the abiding mystery which is the root of all Religion.

21. Although there seems a flagrant contradiction in these two statements—of the Absolute given in Consciousness, and nevertheless transcending Knowledge (which knowledge can only be a mode of Consciousness), we must not lightly credit a thinker of his calibre with overlooking such a contradiction; and we shall find, indeed, that both positions are rigorously consistent in his system of Transfigured Realism. According to this, there are given in Consciousness two factors, "objective and subjective activities, *unknown in their natures, and known only as phenomenally manifested.*" Here, as in the illustration from La-

place (§ 19), I ask, What natures? Mr Spencer says that "all our interpretations contain the two unknown terms, and no interpretation is imaginable that will not contain the two unknown terms" (*Replies to Criticisms: Essays*, vol. iii. p. 288). But *are* the factors unknown terms? They may be terms which have other values in other relations, but in *this* relation their values are known; nor could they be known at all except under some relation, as he has repeatedly said. To say that the subjective activity—Feeling—is only known "as phenomenally manifested," means that it is only known in those particular relations of its existence, and that we can conceive it existing under other relations. But what superior reality is to be assigned to this conception? And on what evidence are we to conclude that the subjective activity is in itself that which is *not* manifested, its

real nature being wholly unallied to what is felt, and known through Feeling?

22. Our conception of abstract Being is that of Existence in all possible relations to Sentience, and *this* cannot of course be limited to any one group of actual relations. I, who am variously affected by the existents around me, cannot be affected by the existents which in remote planets affect other sentients; yet, on the assumption that these remote planets form a continuity with our planet, I know something of Existence *there* in knowing it here. I can even know this Existence as Infinite in knowing *a few terms of the series of which it is the continuous expansion.* That is to say, in knowing a part, I am not utterly ignorant of the whole which is continuous with it; as the man who knows Brittany is said to know France. No one ever pretended that our knowledge of the Absolute was, or could be, exhaustive. The debate turns upon whether it can be known at all. And when the Absolute is admitted as given in Consciousness, given therefore in Experience, we ought to conclude that it is knowable in the same sense that experiences are known.

23. But Mr Spencer defines knowledge so as to exclude this conclusion. "Positive knowledge," he says, "does not, and never can, fill the whole region of possible thought. At the uttermost reach of discovery there arises, and must ever arise, the question—what lies beyond?" This is so; but it only says that beyond the actually Known lies the possible Unknown. And although we can think this possible existence, we can only think it as identical with the actual existence; for the Unknown can only be thought in

terms of the Known.* This remark is called for because of the limitation which Mr Spencer affixes to the epithet "positive" applied to knowledge. By this he distinguishes the scientific from unsystematised knowledge, and thence is entitled to assert that knowledge cannot monopolise Consciousness; which being obvious, leads him to the further statement that "it must always continue possible for the mind to dwell upon that which transcends knowledge" (*First Principles*, pp. 16, 17). Let us pause to consider what the term "mind" denotes here. If it does not denote knowledge, nor any definite form of Consciousness, it must denote what he elsewhere speaks of as the "raw material of Consciousness;" but in any case there is the difficulty of forming a definite idea of this "mind dwelling on what transcends it;" what it dwells on—be it feeling or thought—must stand to it in a particular relation, and cannot *in* that relation transcend it. He has truly said: "Besides that *definite* consciousness of which Logic formulates the laws, there is also an *indefinite* consciousness which cannot be formulated. Besides the complete thoughts, and besides the thoughts which, though incomplete, admit of completion, there are thoughts which it is impossible to complete, and yet which are still real in the sense that they are the normal affections of the intellect. Every one of the arguments by which the relativity of our knowledge is demonstrated distinctly postulates the positive existence of something beyond the relative. . . . . The very demonstration that a *definite* consciousness of the Absolute is impossible to us presupposes an *indefinite* consciousness of it" (*First Principles*, p. 88).

* PROB. III., chap. vii.

24. An objection presents itself in the fact that *indefinite* consciousness is not necessarily excluded from knowledge. That there is an indefinite distance, or an indefinite number, does not exclude the facts of distance and number from knowledge. Apply this to the Absolute, which is indefinite so far as comprehension of all its varieties is concerned, but positive in so far as it is given in every particular form of Consciousness. What is given in the elements cannot be absent from their combination. The formed material of Consciousness must contain the raw material; the conception extracted from perceptions must express what is in the perceptions. Therefore if the Absolute is *felt* it may be *known*—known in the concretes and in abstraction—known in experiences of existents, and in their generalised abstraction, Existence.

"Und es ist das ewig Eine
Das sich vielfach offenbart." *

25. Mr Spencer argues that the Absolute arises in indefinite consciousness as that which remains persistent when all the definite forms are got rid of. "That which is common to them all, and cannot be got rid of, is what we predicate by the word existence. Dissociated as this becomes from each of its modes by the perpetual change of those modes, it remains as an indefinite consciousness of something constant under all modes—of being apart from its appearances" (p. 95). Instead of "*apart* from," I should say, "*in* all appearances." Thus rectified, the argument may be

* GOETHE. These lines may be paraphrased by TENNYSON'S line :—
"And God fulfils Himself in many ways."

accepted, and may be applied to any other abstraction, such as Motion, Life, Colour, Hardness. Of these also we must be said to have only an indefinite consciousness. Of these also it must be said that they are not *like* anything else—a remark which is suggested in answer to his argument (p. 81), that the Absolute cannot be known at all, because to be known it must be classed: "To be positively thought, it must be thought of as such or such, as of this or that kind. Can it be like in kind to anything of which we have sensible experience? Obviously not." Why not? Because it is no one sensible experience, but a generalisation of experiences. Motion, the abstract, is *like* no other abstraction, and in a certain sense may be said to be unlike all particular motor-experiences; but our knowledge of Motion is not denied. If we hold that there is a Motion which is a reality apart from the particular movements, and an Absolute apart from its phenomenal manifestations, we may consistently hold both to be unknowable; on the contrary, if we hold that Motion is the abstract expression of all movements, and the Absolute the abstract expression of all existents, we cannot deny them to be knowable, in any rational sense of that word.

26. If the Absolute, or Noumenon, be taken for the whole of Existence, and distinguished from that small part which, standing in relation to Sentience, is called its Phenomenal Manifestation, there will be no one to dispute the position that we can only know relative and phenomenal Existence. My position simply is, that this knowable part is a reality, since it is a part

of the great Real. The scepticism which attempts to dissolve this reality in mere appearance, and the theory of Transfigured Realism which robs it of any but a symbolical significance, seem to me equally at fault. Mr Spencer is far from adopting the extravagances either of Scepticism* or Idealism, and has powerfully vindicated Realism against both. He has, moreover, argued that, "though only known to us under relation, Matter is as real in the true sense of the word as it would be could we know it out of relation; and further, the relative reality which we know as Matter is necessarily represented to the mind as standing in a persistent or real relation to the absolute reality" (p. 167).

Wherein, then, lies our difference? It lies in the theory of knowledge, and the consequent distinction between the Absolute as the symbol of a Reality *not* identical with its Manifestations, and the Absolute as a symbolical expression of a Reality which exists *in*

* It is needless to cite examples, but the following passage occurs in a work not likely to fall under the eye of many readers, and may be cited to show how the doctrine of Nescience rests on the imperfect discrimination of abstractions from concretes:—"Calculamos continuamente el tiempo, y la metafísica no ha podido aclarar bien lo que es el tiempo; existe la geometría y llevado á un grado di admirable perfeccion; y su idea fondamental, la extension, está todavía sin comprender. Todos moramos en el espacio, todo el universo está en el, le sujetamos á rigoroso calcolo y medida; y la metafísica ni la ideología no han podido decirnos aun en qué consiste; si es solamente una idea, si tiéne naturaliza propria, no sabemos si es un ser ó nada."—BALMES: *El Criterio*, p. 108. That is: in spite of our exact Geometry, we are said to know nothing whatever of the Space which Geometry deals with, not even to know whether there is Space at all. After this we need not be surprised to find him declaring that "the man who is in love feels Love, but knows nothing of it"—man knows what he feels, and calls this feeling Love.

its Manifestations. He believes the Thing in itself to be the Real, and the Thing in relation to us to be a symbol of it. I believe the conception of Thing in itself to be simply the symbol of that *otherness of relation* which the Thing we perceive may be *inferred* to present when it is no longer in relation to us, or is considered in relation to something else.

27. Mr Spencer holds that the universe is only interpretable in terms of Force, and "Force is unknowable." I have endeavoured to show that Force is only interpretable in terms of Feeling, which is essentially knowable, being indeed the source and content of all knowledge. "All other modes of consciousness are derivable from experiences of Force, but experiences of Force are not derivable from anything else." I should reverse this, and say experiences of Force are the feelings viewed from the objective side. All we know of Force is what is given in Feeling. "Force, as we know it, can be regarded only as a certain conditioned effect of the Unconditioned Cause, as the relative reality indicating to us an Absolute Reality by which it is immediately produced." Unless this means a particular case of a general law, we may ask how it can be known that there is an Unconditioned Cause, and that Force is its conditioned effect?

Mr Spencer holds that there is an ever-present Reality *given* in Consciousness, but only *known* indirectly, and through symbolical representations which are wholly unlike the reals. I hold that this Reality is directly known in its actual relations to Feeling, and indirectly known as a possibility of other relations.

The reals known to us are indirectly conceived as parts of a larger whole, and those parts which transcend actual knowledge, together with those which transcend possible knowledge, are the Unknown and the Unknowable Reals; but their postulated existence cannot be allowed to disprove the certainty of the actually felt. Still less can we successfully found a Religion on the admission of this Unknowable; for Religion, which is to explain the universe and regulate life, must be founded on the known and knowable relations.

28. I foresee an objection which some of my readers may raise, namely, Is not the Absolute the unknown quantity of which phenomena are the functions? It is thus conceivable. But observe, when y is said to be a function of x, and varies with it, we assume a knowledge of the variations of x, although ignorant of its numerical value. That is to say, unless x is akin to y in following the same numerical laws, we cannot operate on it through y. Thus the height of the barometer may be a function of the weight of the atmosphere; the velocity of a falling body may be a function of the distance; the quality of a tone may be a function of the rapidity of the rhythmic air pulses, &c.; but in each case the effect is the procession of its cause, and the community is proved. Without this community there would be no such relation: the colour of the barometer, for instance, is no function of the weight of the atmosphere. If, therefore, there is no community between the Absolute and its phenomena—the unknown quantity and its functions—we cannot connect them; whereas, if there is this

community, we are dealing securely with *it* in dealing with *them*.

29. This leads me to another objection. The Absolute, or Thing in itself, is likened to a blow in the dark. We feel a pain, and assign a cause; but not clearly knowing what is the nature of that cause, we say it is "something" outside us. It is thus we assign an unknown cause for the effects of the sensible external. We know the effects, it is argued, but are ignorant of the causes. This objection I hope to have satisfactorily anticipated in showing that effects are the processions of the causes; but it may be answered also from another side. Why do we ascribe the pain to a blow, and the blow to some external agent? Simply owing to the accumulated experiences of similar feelings which have organised this judgment in us. What is immediately given in Consciousness is a change of feeling. The localisation of that feeling in a particular part of our body is accompanied by a revival of similar feelings, of which the known antecedents were the kick of a schoolfellow or the cane of a master. Had these been the only known antecedents of these feelings, the blow in the dark would not have been ascribed to some unknown cause, but to one of these causes. But since similar pains have been experienced under various conditions, we hesitate in ascribing the present feeling to any one, and ascribe it vaguely to "something." This unknown cause is, however, presumably knowable; it is not thought to be an agency unallied with those of previous causes, but an agency similar to those.

"So weit das Ohr, so weit das Auge reicht
Du findest nur Bekanntes, das Ihm gleicht." *

It is this generalisation of Cause which is expressed in the term Absolute. Given in every particular experience as the objective factor, it is raised into an abstract conception, and then substantialised. But if this be so, then assuredly we know the Absolute, as all other abstractions are known.

30. Mr Martineau confesses that inductive science gives no access to "causes behind phenomena." Why then are they postulated? It is because the idea of causality is not to be expelled. If this idea "be a metaphysical *datum*, it is no wonder that we miss it as a physical *quæsitum*; nor is it difficult to understand why it presents no variety to our mind, however various the phenomena behind which it is planted, or the corresponding changes of name it may assume. By an irresistible law of thought, all phenomena present themselves to us as the expression of power, and refer us to a ground whence they issue. This dynamic source we neither see, nor hear, nor feel; it is given in *thought*—supplied by the spontaneous activity of the mind itself as the correlative prefix to the phenomenon observed." * I have already traced the genesis of this idea so fully, that I need say nothing more on the point; let me only adduce an illustration. In the various hard substances which we have touched, there has been one quality common to them all, one feeling which has mingled with all the varieties of accompanying feelings; this we detach and call Hardness. This Hardness being an abstraction, no wonder if

* GOETHE.

we miss it as a physical *quæsitum*; no wonder if it presents no variety to our mind; no wonder if we make it the correlative prefix to the phenomena observed; but are we therefore entitled to say that it is planted behind the phenomena, or that it is anything more than an abstraction from our concrete experiences?

CHAPTER IV.

MOTION AS A MODE OF FEELING.

31. THE identity of Object and Subject—within the sphere of the knowable—has gained general acceptance among philosophers, without obliterating the well-marked logical distinction of those two aspects of Existence. The identity of Matter and Force has also gained general acceptance; meanwhile the researches of physiologists have more and more tended to confirm the doctrine that certain neural processes have feelings as concomitants, and that no feeling can arise except under certain conditions of molecular change in the nerve-centres. Nevertheless the conclusion to which all these lines converge will probably meet with decided and even contemptuous rejection, the conclusion, namely, that Motion is a mode of Feeling.

Nor is this surprising. The love of drawing sharp distinctions, the love of mystery, and the love of stultifying dogmatic confidence by an equally dogmatic scepticism, all unite in proclaiming the gulf between Motion and Feeling to be unbridged, unbridgable. Here, at any rate, Science, it is said, must acknowledge its impotence; however clearly it may trace the course of molecular movements from the

excitation of a sensory nerve to its final discharge on a muscle, the transformation of a neural process into a sensation remains an impenetrable mystery. Motion we know, and Feeling we know; but we know them as utterly different; and how the one becomes changed into the other, what causal nexus connects the two, is a question which can never be answered.

32. Such is the argument urged in a hundred different quarters.* The force of it, when the facts are so presented, is irresistible. But are the facts correctly stated? That the *passage* of a motion into a sensation is unthinkable, and that by no intelligible process can we follow the transformation, I admit; but I do not admit that there is any such transforma-

* "I hardly imagine that any profound scientific thinker who has reflected upon the subject exists who would not admit the extreme probability of the hypothesis that, for every fact of consciousness, whether in the domain of sense, of thought, or of emotion, a certain definite molecular condition is set up in the brain; that this relation of physics to consciousness is invariable, so that given the state of brain, the corresponding thought or feeling might be inferred. But how inferred? It is at bottom not a case of logical inference at all, but of empirical association. You may reply, that many of the inferences of science are of this character; the inference, for example, that an electric current of a given direction will deflect a magnetic needle in a definite way; but the cases differ in this, that the passage from the current to the needle, if not demonstrable, is thinkable, and that we entertain no doubt as to the final mechanical solution of the problem; but the passage from the physics of the brain to the corresponding facts of consciousness is unthinkable. Granted that a definite thought and a definite molecular action in the brain occur simultaneously, we do not possess the intellectual organ, nor apparently any rudiment of the organ, which would enable us to pass by a process of reasoning from the one phenomenon to the other. They appear together, but we do not know why."—TYNDALL: *Address to the Mathematical and Physical Section of the British Association*, 1868. To the same effect, MILL: *Logic*, ii. 436. DU BOIS REYMOND: *über die Grenzen des Naturerkennens*, 1872, p. 17. GRIESINGER: *Maladies Mentales*, 1865, p. 7. DONDERS in the *Archiv für Anat. u. Physiol.*, 1868, p. 658. LOTZE: *Mikrokosmus*, 1856, i. 161.

tion. When I am told that a nervous excitation is *transformed* into a sensation on reaching the brain, I ask, Who knows this? On what evidence is this fact asserted? On examination it will appear that there is no evidence at all of such a transformation; all the evidence points to the very different fact that the neural process and the feeling are one and the same process viewed under different aspects. Viewed from the physical or objective side, it is a neural process; viewed from the psychological or subjective side, it is a sentient process.

.33. In expounding this theory I shall ask permission to take certain principles for granted, since it is obvious that to enter upon a discussion of them here would require a volume. First, then, it is taken for granted that Mind, Consciousness, Feeling (whatever term be selected to express sentient phenomena), is a function of the organism; and this both in the mathematical and the biological senses of the term.* This position may be accepted by the spiritualist, in so far as he also regards the organism as the agent.

Secondly, I take for granted that the living nervous mechanism has one general mode of action which may be called Sensibility. This general mode manifests itself in sensible tremors, groups of such, and groups of groups—in sensations, perceptions, emotions, conceptions—which are never manifested apart from this mechanism, and which vary with every

* In the mathematical sense, a function is a quantity which depends on and varies with another quantity, so that if y is a function of x, any variation in x brings a corresponding variation in y. In consequence of this dependence we may indifferently take x as the function of y, or y as the function of x. In the biological sense, a function is the action of which an organ is the agent.

variation in the molecular movements of that mechanism.

Thirdly, I take for granted the truth of the doctrine enunciated in PROBLEM V., namely, that the logical distinction between the conditions of a phenomenon and the phenomenon itself is simply an artifice, there being not two things, a group of conditions (causes) on the one side, and a result (effect) on the other, but one thing differently viewed. What we call the conditions are just the analytical factors we have detected in the fact. Hence when we say that all the manifestations of Sensibility have their conditions in the molecular condition of the nervous mechanism, we say they *are* the actions of that mechanism; just as all the manifestations of Contractility have their conditions in the contractile muscular tissue. To urge that we do not know how these manifold conditions emerge in the phenomenon Feeling, is to say that the synthetic fact has not been analytically resolved into all its factors. It is equally true that we do not know how Water emerges from Oxygen and Hydrogen. The fact of an emergence we know; and we may be certain that what emerges is the *expression of its conditions*,—every effect being the procession of its cause.

A spiritualist may here object that we have no right to exclude from the group of conditions that spiritual agent which he regards as the chief among them. But the answer is twofold: first, there is no evidence whatever for the existence of such an agent; secondly, there is overwhelming evidence that the function varies with the variations in the physical conditions, in other words, that the sen-

tient phenomenon is a nervous phenomenon. If, therefore, y varies with x, and x with y, we cannot rationally assume a third quantity, having no relation to x, in order to account for y.

34. According to all physiological induction, the complex organisms, if not evolved from the simpler organisms, are assuredly constructed on similar organic bases. Both complex and simple are essentially identified with the Medium in which they live, and from which they are differentiated only by formal rearrangements. The material of the Medium passes into the Organism, and after a while is again restored to the Medium. The systole and diastole of Life is this interchange, this incorporation and discharge of molecules and molecular motions. Wonderful and complicated as are the molecular movements of Nutrition, they are only special cases of dynamic laws. The irritability of a plant, the contractility of a muscle, the movement of a ciliated cell, or of the molecules within that cell, require no hypothesis of a Vital Principle for their explanation; and indeed that hypothesis has now been so generally rejected by biologists, that we may consider it finally disposed of. But the same arguments which render nugatory the Vital Principle, also render nugatory the hypothesis of a Psychical Principle. The complicated and special group of molecular forces in muscular contractility, which we partly detect and partly infer, requires the *absorption* of molecular motion in the *building up* of the muscular tissue, and the *expenditure* of that energy in muscular action. The phenomena of Nutrition, Development, Decay, and of muscular Action, are what may be termed the *directed sums* of

the molecular movements incessantly going on in the living tissues. To these are superadded, in the higher organisms, the various phenomena of Sensibility—sensations, perceptions, emotions, instincts. Nor do we need the intervention of a Psychical Principle to account for these, if by it we are to understand the introduction of an agency which is not molecular energy. The law of continuity excludes the hypothesis of a distinct spiritual substance; the law of indestructibility excludes the appearance of a new energy, when new forms of the old substance and old energy are all that is intelligible. No doubt the new *forms* are special, and require special names. We must always distinguish vital substance and vital actions from inorganic substances and inorganic actions. In like manner we distinguish Sensibility from Contractility, and Thought from Sensation. But when we attempt an analytical explanation of the conditions of Thought, all that we can reach is the combination of elementary facts of Sensibility: which in their turn are objectively reducible to molecular movements in the nervous mechanism. If it be said that this analysis fails to exhaust all the conditions, and still leaves us in presence of an unsolved mystery, I admit and emphasise the fact, but remind the reader that precisely the same mystery confronts us when we are dealing with the phenomena of inorganic substances. So far as knowledge reaches, the forces at work in Consciousness are the forces at work in the Organism; and the forces at work in the Organism are the same in kind as those in the Cosmos: there, as here, Force is nothing but *mass acceleration*. A stream of molecular energy flows through the organism from the great cosmic

source, and returns to the ocean whence it came. For the organism is but an unit in the great sum of things. The continuity of Existence admits no break. Our life is a moment in the larger life.

35. This is very evident when viewed in detail. Thus the process of Respiration is one on which the continuance of the vital processes is dependent. What is it but an interchange of gases between the organism and the medium? The oxygen passes from the air into the blood, and is restored to the air in the form of carbonic acid. Nowhere is there a line of demarcation interrupting the real continuity. If from Respiration we turn our attention to Nerve-action, the same absorption of the external medium is apparent. It is the external impulses which set free the molecular energies of the sensory nerves. To suppose that Sensation is anything more than a new combination of elementary energies, is to release our firm hold of knowable conditions, and fly for an explanation to what is unknowable. We may not deny that over and above the physical and chemical conditions there are vital and psychical conditions which are very obscure; but these we can only refer to special combinations of the elementary motions, for we must maintain the continuity and unity of Existence; and since every phenomenon is the resultant of its conditions, every variation in the combinations of the units must give a new phenomenon. It is no denial of the *speciality* of vital or psychical phenomena to reduce them to the same elementary motions as those manifested in cosmic phenomena. The various social phenomena are extremely unlike those of the solar system; no one would

for a moment confound them; yet both are reducible to the same dynamic laws.

36. It is not wonderful that conceptions so dissimilar as those of Motion and Feeling should seem irreducible to a common term, while the one is regarded as the symbol of a process in the object, and the other as a process in the subject. But psychological analysis leads to the conclusion that the objective process and the subjective process are simply the twofold aspects of one and the same fact; in the one aspect it is the Felt, in the other the Feeling. I do not intend to affirm that the change in external existence (which is known to us as Motion) is simply the change in us, and has no place in the universe irrespective of Feeling; for I reject the hypothesis of Idealism. But whatever this change may be outside the sphere of Sentience, *within* that sphere it is the felt Motion, and it is nothing else; just as the ethereal waves are colours, and not movements, within the sphere of retinal sensibility. Strictly speaking, the feeling we name Motion is a *special* feeling, which is not discoverable in other modes of Sentience; but by a procedure presently to be explained it furnishes *the terms into which all other feelings are translated*, when these are viewed objectively. Having this objective character, and seeming to mark that which is distinctively the Not-self, it is isolated in abstraction from Feeling, and the abstraction inevitably becomes substantialised, so that the two aspects assume the position of two entities, and philosophers then puzzle themselves with the question, how two entities thus opposed in nature can be brought into connection, the one acting on the other? Object and Subject, Matter

and Mind, Motion and Feeling, seem irreconcilable opposites; and logically they *are* opposites, mutually exclusive; whence, then, their interaction?

37. The Cartesians and Leibnitzians tried to reconcile the fact that animal motions were mechanically explicable, with the fact that nevertheless these motions were not, and never could become, sensations. Descartes supposed that the animal organism was a machine without a soul, and the human organism a similar machine to which a soul had been superadded. He maintained that the quantity of motion in the universe was constant, the directions only being variable. The soul did not move the human machine, but ordered its movements, as a general orders the movements which his troops execute. The movements which in man were directed by a God-given soul, were, in animals, directed by a divine Plan. The notorious influence of the body on the mind, physical changes causing mental changes, was declared to be a mystery. Leibnitz modified this hypothesis; while equally bent on keeping the gulf impassable between Motion and Feeling, Matter and Mind, he explained their seeming community of action by the divine plan of a Pre-established Harmony, in virtue of which the movements of the body and the soul corresponded like the movements of two clocks.*

In our day both hypotheses have fallen into discredit. Philosophers for the most part are unwilling to deny souls to animals, and are still more unwilling to regard men in the light of automata; but they are

* I have treated this at length in the 4th edition of my *History of Philosophy*, ii. 276, *seq.*

puzzled to reconcile the facts of movement determined by consciousness, and of consciousness determined by external movement, with the admitted opposition between Motion and Feeling, on the one hand, and on the other the well-established laws of mechanics and the conservation of energy. One school keeps to the tradition of a spirit, or ψυχὴ, which regulates the mechanism. The other school regards the organism as a mechanism which transforms Motion into several different modes—into heat, chemical affinity, electricity, muscular contraction, &c.—all in strict obedience to the conservation of energy. But since what is meant by Sensation is wholly unlike any of these, and in every way distinguished from Motion in all its known modes, and since, moreover, it is held to be an unquestionable fact that Motion in the brain becomes transformed into Sensation, they declare the fact to be an impenetrable mystery; the passage is, and must always remain, inconceivable.

38. The inconceivability I admit, the fact I question. Instead of accepting it as an unquestionable fact that the bodily state *produces* the mental state, —standing to it in somewhat the same relation as the discharge of a gun to the death of a bird—I conceive this to be a baseless assumption, which can only be sustained by the erroneous notion of causation as mere antecedence. There is abundant evidence that some external movement precedes an internal change, and that this change in a sensory nerve precedes a neural process; but there is absolutely no evidence that this neural process precedes and produces its sensation. If it did, the law of the conservation of energy would be at fault, since a motion would terminate in what

was neither Motion nor a mode of Motion. Mr Mill, expressing the current opinion, says, "Let it be shown that the most complex series of physical causes and effects succeed one another in the eye and brain to produce a sensation of colour, ... still at the *end* of these motions there is something which is not motion, there is a feeling of colour." I reply that the production is a fiction; from first to last there has been a series of physical sequences, which, viewed subjectively, has been a series of sensations. The external motion has been transformed into a neural excitation, as a violent motion of the air may be transformed into the explosion of a nitrogeneous compound. But to ask how this neural excitation becomes transformed into a sensation, is equivalent to asking how the material of a yard measure—which is a substance—can be transformed into an unit of length—which is an idea. The length is not the substance, nor is the substance the length; the two aspects, although essentially different as conceptions, are nevertheless two aspects of the same real in its different relations to Feeling. Or—to take an illustration more nearly allied to the case—suppose we were asked, What takes place in the transformation of a muscular excitation into a muscular contraction—how is contractility, when excited, *connected* with a contraction? The question is seen at once to be absurd, unless it mean, What are the known conditions of living muscular tissue, and the modes of reaction of that tissue under stimulation? That is a physiological inquiry. And if, having ascertained what these conditions are, we isolate them in thought, setting apart on the one hand the tissue, and on the other the agent of stimulation, assuredly nothing can be more

unlike these than the contraction, which is their result. But this isolation is an artifice; in reality the contraction *is* its conditions, and not anything superadded to them. The only transformation here is not of the conditions into something wholly unallied to them—but of certain analytical factors into a synthetic fact.

So with the supposed transformation of a neural process into a sensation. The process is the objective aspect of the sensation. Instead of our feeling the sensation of sound, of colour, or of fragrance, we are mentally looking at the changes in the sensory organ. Translating the subjective feeling into objective terms, we see the conditions of that feeling to be a living nervous mechanism and its mode of reaction under a stimulation. Having ascertained this, we isolate in thought the nervous mechanism from the living organism, and the stimulus from the stimulation; a permissible artifice, a necessary artifice, but unhappily one which is easily lost sight of, so that we accept the logical distinction of an agent from its agency, the stimulus from its stimulation, and suppose the distinction to be real. It is not so. An agent can be that agent only in its agency, a stimulus is such only when it stimulates. One agent is a remote cause, which, as a stimulus, is the proximate cause, and a proximate cause *is* its effect. The object isolated in abstraction is a *possible* agent, but is not *really* an agent at all apart from the co-operant organ. The acid which is a stimulus to my skin is not *that* stimulus to your eye when you look at it. Hence the law that stimulation is proportional to the external cause —(the modification proportional to the intensity of

the modifying agent)—although a convenient formula. of objective relations, is simply another way of saying that the stimulus and the stimulation are two aspects of the one fact. What objectively is the stimulus, *i.e.*, agent *and* organ, is subjectively the stimulation.

39. Owing to our habitual abstraction of the object from the subject, and the consequent belief in their real separation, the law of proportionality seems frequently at fault; indeed, so far from the intensity of a stimulation having a constant ratio to the intensity of the stimulus (one agent) the ratio appears strangely variable. Thus doubling the quantity of the external agent does not necessarily produce a double intensity of sensation—the sound of twenty cannon fired simultaneously is scarcely distinguishable from the sound of ten. This is alleged as disproof of the law; it is nothing of the kind. A quart pot will only contain a quart of liquid, whether the quantity *from* which the pot is filled be a quart or twenty gallons. The stimulus being only a stimulus in so far as it stimulates, the measure of the stimulation is the measure of those quantities which are its components, not of the universe outside them. The sensory organ has its particular capacity, which is its potential energy, and when this, its statical condition, is disturbed by some force, the disturbance is the stimulation or liberation of its energy. But we cannot measure the energy liberated by measuring the external cause, considered apart from its co-operation with the sensory organ. The stimulation (sensation) is a differential; and a differential being simply a difference (and not, as commonly supposed, an infinitesimal), may be of any magnitude. Thus when two weights which, if tested by

the scales, show a difference of one-seventeenth, are tested by muscular Feeling, no difference is sensible: it is not until the difference surpasses one-seventeenth that it becomes appreciable to Feeling. Although we can appreciate the weight of a single ounce, or a single pound, by itself, yet if a single ounce be added to thirty ounces, or a single pound to thirty pounds, the addition is insensible. The law of proportionality therefore is absolute.

Nor would it have been doubted but from that common fallacy of isolating one part of a process from the rest, considering it as the cause, and so separating the effect from the cause. An external motion is thus said to cause a sensation, no regard being paid to the sensory organ. The excited neural process is said to cause the sensation; and cause and effect being thus separated, we are told that sensation is the *product* of the neural process, and is something *distinct* from it; the physical state is said to be the antecedent of the mental state. Whereupon arises the difficulty of explaining how anything so unlike a sensation as a neural process can be the product of that process. The expansion of a gas, in like manner, is said to be caused by the increased sweep of the oscillation of its molecules. But surely the expansion *is* this increased oscillation, viewed as the directed sum of all the oscillations? It is not something added to them, produced by them. A supersaturated crystalline solution, or certain explosive compounds, may be transformed into crystals, or explosions, if agitated by aerial pulses; and these same aerial pulses agitating the molecules of the auditory mechanism will produce the sensation of sound. We may then ask, What

resemblance is there between Crystallisation, Explosion, and Sound? which would be quite as pertinent an inquiry as that of What is the resemblance between the motion of some external agent and the sensation it produces? It is *not* the external agent which produces the sensation; the sensation is the co-operation of that agent with the sensory mechanism. It is not the aerial pulsation which produces the crystallisation or the explosion, but its co-operation with the forces of the solution or the compound. The aerial motion is absorbed by the bodies, and modifies their motions by blending with them; the result of this blending is that the molecular movements of the solution acquire definite paths, which give the geometrical forms of crystals; the molecular movements of the gases have acquired a wider sweep, which is manifested in the explosion of sudden expansion; the molecular movements of the nervous tissue have in like manner acquired a new direction, and the liberated energy is manifested in a neural process, which is sensation.

40. It will be objected that the parallel does not hold, because in the cases of the crystallisation and explosion we have still only phenomena of Motion, whereas in the case of Sound we have the altogether unique phenomenon of Sensation. Viewed in their objective aspect, all three may be motions, but the peculiarity of Sensation is that it is a subjective phenomenon, and from all the evidence within our reach no such subjective phenomenon can be ascribed either to crystallisation or explosion.

I answer, that since the subjective aspect is necessarily limited to the conscious subject, it cannot, without violation of the logical distinction which

the terms express, be ascribed to an object; and further, that all relations of the object are expressed in terms of Matter and Motion—these being our symbols of the Felt—whereas all relations of the subject are expressed in terms of Feeling and change of Feeling. Hence it is that whenever Feeling is regarded from the objective side it appears as Motion.

40*a*. Note here that the *innerness* which distinguishes Feeling renders the explanation of its objectivity—*i.e.*, its *otherness*—impossible, if we suppose it passing from the one to the other. Between two such opposites there can be no bridge. They confront each other, and exclude each other. For the same reason, when we have made a sensation or a thought an "object," and contemplate it as a state of Consciousness, we are equally unable to see its connection with that Consciousness of which it is the "state"—that soul of which it is the "manifestation." It is this difficulty which has originated the hypothesis of a noumenal Ego. We can no more render intelligible the passage of a noumenon into a phenomenon, than the passage of a motion into a feeling. But I deny that there is a passage in either case. Noumenon and phenomenon, feeling and motion, are contrasted aspects, not different entities.

41. It is easily shown that every objective phenomenon is at the same time a subjective phenomenon. The movements of the air, which are said to be the cause of the sensation of sound, no doubt represent some cosmical change which is, or may be, quite independent of any sentient change; but this change can only be expressed in terms of Feeling, because only through changes in Feeling can it be a pheno-

menon to us. The air is a group of qualities, and qualities are feelings; the waves — their rapidity, amplitude, &c.—are obviously feelings which are projected outside of us; and although it is true that we are compelled to postulate cosmical factors as co-operant with sentient factors in the production of these feelings, we cannot separate these in any one phenomenon, we can only isolate them in abstraction. Although a motion is a feeling, and a feeling is only interpretable in terms of Motion, whenever we consider this process of change *as* Motion the subjective aspect disappears, and whenever we consider it *as* Feeling the objective aspect disappears.

42. To explain Feeling as a mode of Motion has been generally pronounced absurd. I am not aware that any one has endeavoured to explain Motion as a mode of Feeling; yet this is the conclusion which forces itself upon my mind, and which seems to reconcile all the difficulties that have been raised. Motion is a symbol of a particular class of feelings, as Colour is of another, Sound of another, Heat of another; but we never suppose the sensation of colour to be a mode of the sensation of sound, nor the sensation of heat to be a mode of sound. If Motion, although a particular mode of Feeling, is nevertheless employed in explanation of other modes, and thus assumes a generality equivalent to that of Feeling, this is owing to a psychological law which we shall now try to expound.

43. It is a fact that we express all objective aspects in terms of Matter and Motion, and all subjective aspects in terms of Consciousness. Motion expresses the changing positions of objects in Space—*i.e.*, redistributions of Force—and thus, metaphorically, comes

to express the changes in Consciousness when these are viewed objectively. All our experience leads to the belief that every change in external phenomena is the effect of a change in the relative positions of objects—redistributions of their forces; one thing is made to act on or with another by being detached from one position and brought into another. Whether we see this changing process or infer it, we believe that the new phenomenon is its expression. Matter has its indestructible Activity, and phenomena are its manifestations. But Matter to us is the Felt, and therefore all its manifestations are changes in our Feeling; and although these changes are very various, and the manifestations have extremely different forms in Consciousness, a flash of light being unlike a burst of sound, and a thrill of pain unlike a glow of warmth, nevertheless we inevitably translate even these into terms of Matter and Motion when we think of them objectively. The feelings derived from visual experiences —those of space and changing positions—combining delicate and varied muscular sensations with retinal sensations, so predominate in our mental constructions that we inevitably translate all other feelings into terms derived from vision; and this is true even of the purely intellectual forms, so that we are said to see clearly what we think clearly, and the changes of thought are called *trains* and *movements*. The spiritualist is equally unable to escape this necessity of employing the terms derived from objective aspects to express the subjective aspects. What we call movements in the sensorium, he calls movements in the spiritual substance; and the reason lies in the nature of interpretation. Feeling is an intensive

magnitude, and all intensive magnitudes are measurable only by extensive magnitudes (§ 4). Thus it is that Time is measured by Space-relations, and Motion by Space and Time-relations: Time not being measurable by times, nor Motion by motions, as Space is by spaces. Thus also Feeling, which is subjective, has to be translated into objective terms of Space and positions in Space—terms of Matter and Motion—before it can be interpreted. For whenever we inquire what anything is, we always seek its interpretation in something else—we seek the class to which it belongs, and which we are supposed to know better. If we ask, What is a dog? we are told that it is an animal, a vertebrate, a mammal, a carnivore, &c., we being supposed to know what these terms express; or, failing that, we are told that the dog is like a wolf, a fox, a hyæna, or some other dog previously known to us. In no case are we instructed by being told the dog is a dog. If we ask, What is a sensation of sound? we refuse to accept as an explanation that it is a sensation of sound; but are instructed if told that it is one of the forms of Feeling, and comparable with sensations of touch, taste, sight, &c.; or that it is the reaction of the auditory organ under stimulus, due to a molecular movement in the auditory tract. We do not want to be told what is the sensation we feel, but what class of existences that sensation may be ranged under, and what are the conditions of its existence. Now, it is noticeable that, in interpreting thus any objective phenomenon, we rarely have recourse to subjective terms: we do not say the object is a group of feelings, but a group of qualities; whereas in interpreting a subjective phenomenon, we

always have recourse to objective terms; although the sensation of sound is recognised as belonging to the subjective class of feelings, we are forced to interpret its conditions of existence in objective terms, and these are always derived from visual and tactual experiences. The feeling of sound has nothing whatever to do with visual feelings, and is in consciousness markedly distinguished from them; yet we nevertheless translate it into terms of visual feelings, and speak of it as *high* or *low*, and of its physical conditions as *waves*. Whether we consider the vibrations of the sounding body, the waves of the air, the agitation of the auditory tract, or the rhythm of feeling, such conditions are all visual and tactual qualities, and have no resemblance whatever to the quality named sound. Note further, that it is only the optico-muscular feeling of movement which is called upon to interpret the objective conditions of sensation; no sensation is interpreted in terms of sound, taste, smell, temperature, pain, &c., although these feelings are equally objective qualities; yet each of these is objectively interpreted as dependent on molecular movements.

44. The reason lies deep down in our psychological organism. Muscular innervation is, as I shall hereafter show in detail, a necessary factor in every feeling; being thus common to all, it impresses its objective character on each; and owing to early and incessant association of the muscular feelings with visual experiences, and of visual experiences with tactual and all other external qualities, we come to regard the feeling of movement thus derived as characteristic of every objective change. Not only the changes we see but the changes we infer, are all presented to con-

sciousness in this form; we believe that if the processes of chemical decomposition and recomposition could be presented to Sense they would appear as changes of molecular position; and our belief arises simply from the fact that we always imagine ourselves seeing the change, when of course it presents the visual character of movement. Yet a little consideration will reveal that these chemical processes, when brought into direct relation with other senses, would produce very different feelings; and that, instead of seeing movements, we should feel pain, pleasure, fragrance, flavour, and so on. That we do not mentally reproduce such forms in our inferences respecting the unseen processes, but always reproduce the visual form, and translate the invisible into the visible, arises from the predominance of the eye in objective experiences. The external world has become to us a continuum of sights and touches; to the blind it is a continuum of touches and muscular feelings; to many animals there is good evidence for supposing that it is a continuum of smells and touches: Sight playing the subordinate part in their experience which Smell plays in ours.

45. This predominance of the eye in directing our mental activities, as it directs our voluntary bodily activities, need not be dwelt on, since every reader must at once acknowledge it; but we may illustrate by an example or two the predominance of the eye in impressing on our feelings of change that special character which is known as movement. Motion is not succession simply, nor change simply, but visible succession, visible change. I do not say that a blind man does not acquire perceptions of space and changing positions in space through touches and muscular

feelings, but I say that his perceptions of space and changing positions are not like ours, and that if he calls the feeling of changing positions by the same name as we do, it is because he speaks the language of men who see. His symbol all the while represents very different significates from those represented in our symbol, Motion, which to us is always, and only, visible change.

Let any one close his eyes and walk a few paces. In spite of engrained visual experiences, he will find, on close examination, that the various feelings arising from pressure of his feet on the ground, the contraction of his muscles, &c., have really nothing resembling the feelings of movement which he has when his eyes are open, and he sees a constant change in the position of objects; he will find, however, that he does construct a mental picture of space and changing positions, and that with each pressure of his feet he calls up a vague image of the ground; with the feeling of contraction in his muscles he connects the image of his body changing its position. This is because experience has engrained the visual character in those feelings; but we have only to consider other muscular contractions which have not been thus associated with visible changes, and we perceive at once a marked difference. Thus, whenever we breathe, there is a contraction of the muscles of the ribs and the diaphragm. Since we see the chest expanding, we know it as a movement, and can only think of it as such. But the diaphragm is not seen contracting, and consequently by no one who is not physiologically enlightened on the point, is this diaphragm thought of in movement. Nay, even when told by a physiologist that the diaphragm

moves at each breathing, every one, who has not seen it moving downward, pictures it as an upward movement, because the chest moves upward.

46. You are seated at a concert with closed eyes. A succession of musical feelings forms the dominant series of changes, the main thread of your consciousness. In this succession there is no feeling of Motion. Inosculating with this main thread there are various threads formed of other successions—feelings of cold feet, hot head, hand beating time, eau-de-cologne wafted from some neighbour's handkerchief, &c. So long as these feelings occupy you without being interpreted into their objective aspects or physical conditions, your attitude is purely subjective, and there is nothing that resembles Motion in any one of these feelings; yet one and all will be translated into terms of Motion directly the subjective attitude is quitted and the feelings are interpreted. And thus: You open your eyes, and see Joachim bending over his violin; a vast series of inductions make you connect your musical feelings with his movements. Another series of inductions lead you to the conviction that his movements cause movements in the air, which move your tympanum, and this in turn sets vibrating the liquid in which float the terminations of your auditory nerve, and that nerve agitates the ganglion in which it penetrates, and the agitation of the ganglion is communicated to the brain. From first to last there is here a succession of movements seen or inferred. The external impulse has acted on the internal mechanism, and this action and reaction are explicable in mechanical terms; so that what before was purely subjective feeling and succession of feelings now appears purely

objective movement and succession of movements; yet these objective movements are so utterly unlike the musical feelings, that the idea of the one producing the other, being transformed into the other, is justly declared to be inconceivable.

47. We have, however, good reason for asserting that the Motion which is contrasted with Feeling is strictly speaking only *one mode of Feeling contrasted with all other modes*, and made to represent the objective or physical aspect of phenomena, in preference to any other mode, because of the predominance of the organ whence it is derived. No special sensation, except that of visible changing positions is felt as a movement, but all are expressed in terms of Motion when objectively interpreted. All the facts of Consciousness are thus translated into terms of vision, and all their physical conditions are expressed in physical terms. Let this once be recognised, and a cloud of obscurities melt away. So long as we are considering the physical conditions of the psychical phenomenon, we are dealing with the nervous mechanism, and expressing all the observed results in mechanical terms; the inquiry seeks what are the changes visible to Sight or Inference, in that series of changes many of which are not in the least like the sensations of Sight.

Observe the difference: I trace the series of changes, from Joachim's actions to their musical effects, as a series of visible movements mechanically explicable, because I am *seeing*, or inferring, the vibrations of the violin, of the air, of your tympanum, auditory nerve, ganglion, and brain. You describe part of the series in the same terms, because you also *see*, or infer, the changes; but the latter part of the series presents abruptly a new

aspect in the sensation, not of movement, but of *sound*—your attitude is altered by the intervention of a new Sense; you are no longer seeing *vibrations*, but hearing *sounds*. I, who see what you hear, only know the change in your sensorium as a movement; and it is thus you also represent it directly you pass from the subjective attitude, and try to see *what* you hear. No one can perceive another's perception;* he can only perceive the change in that other's organism, under the form which it presents to the one sense through which he perceives it, namely, under the form of movement when presented to the eye, under that of successive taps when presented to the touch, under that of sound when presented to the ear. If I contract my muscles, a peculiar feeling is produced in me by the muscular sense. If I see this contraction, it is a movement; if I hear it (the sounds are audible), it is neither contraction nor movement, but sound. Three different senses have been affected, and if I assign all three feelings to the same objective condition, co-operating with different subjective conditions, I have, strictly speaking, no more right to call this objective condition a *movement* than to call it a *sound* or a *muscular feeling;* and therefore to say that it is a molecular movement which produces a sensation of sound is equivalent to saying that a sensation of sight produces a sensation of hearing. It is not the wave of air which produces a sound. The wave of air is the visible form, and the sound is the audible

* "No one can stand at the same time at the outside and inside of a phenomenon. Therefore can no mind directly perceive another, although it would seem the easiest thing in the world to perceive what is most like it. The mind has only the bodily manifestation of another mind before it."—FECHNER: *Psychophysik*, i. 4.

form of sensorial reaction under stimulation: the external change co-operating with the eye in the one case, with the ear in the other. Motions, apart from Vision, are as impossible as sounds apart from Hearing. Nevertheless, for the reasons previously stated, we inevitably translate all sensations into terms of Motion when viewing them objectively: as *objects* the feelings are all interpreted by the one sense which predominates in our perception of the external.

48. This has been overlooked by all philosophers with whose writings I am acquainted. Motion, although confessedly a form of Feeling, is taken first to symbolise all external Change, then said to produce all internal change. The sensation of colour, although confessedly not like a sensation of changing positions in space, is said to be produced by movements in the optic tract, these being molecular changes of position. If we inquire into the evidence for this assertion, we find that physiological inductions have assigned the optic tract and its molecular changes as the cause of the effect named colour. We find, moreover, that the common error of mistaking ideal separations for real separations, which leads to the imaginary separation of cause from effect, conditions from their result, leads the physiological psychologist to the conclusion that the objective aspect of the phenomenon, expressed in terms of Matter and Motion as the *neural process*, is the cause of the subjective aspect, the effect, expressed in terms of Feeling as the *sentient process* of colour; and leads the spiritualistic psychologist to the conclusion that the neural process is the cause of a spiritual process, a movement in the spiritual mechanism, the effect of which is the feeling of colour. Now, while

both opinions are assailable, on the ground of their fallacious separation of a result from the conditions it incorporates, while both mistake the difference of aspect for a difference in fact, I confess that to me the spiritualist hypothesis has the greater cogency in one respect, namely, it postulates a distinct agent for a distinct agency. Standing on the admission that a sensation of colour is *not* a movement, nor in any way allied to it, the hypothesis requires that to the nervous mechanism which *moves*, a spiritual agency which *feels* be superadded; whereas the physiologist, instead of invoking a distinct agent for the distinct agency, supposes the nervous movement to pass into a feeling, and does not specify where the new phenomenon arises, nor of what it can be the process—he sets it floating in the inane, content to call it a mystery.

49. The reader knows that I accept neither of these explanations. The neural process and the sentient process are not two processes, but two aspects of one process; and the difference of aspect arises from *the difference of the senses appealed to.* Suppose a feather is drawn across my hand unseen by me; the excitation of my skin-nerves is a sensation of tickling, and that is all immediately given; but owing to an organised tendency this sensation is localised in my hand, and assigned to some external agent; by this the change in me, which is my feeling, is projected outside me, and pictured as a motion, *not* my tickling. This would not be the case with an infant before experience had taught him to associate internal with external changes. He would feel the tickling, but would not translate it into a motion by mentally applying another sense to the objective factor. Only after

many experiences, in which his eyes had been directed towards the part of his body where he had learned to localise sensations, would the sensation of tickling be connected with the sensation of seeing a feather move across his hand. It is obvious that these two sensations are very different neural processes; the action of the moving feather on the skin-nerves and optic-nerves is in both cases interpretable, in terms of Matter and Motion, as a molecular movement liberating the energy of the nervous centres; but this liberated energy is in each case conditioned by its centre. In the complex feeling, which is the sight of the moving feather, there are clusters of manifold experiences by which the agent is recognised as a feather, and as moving. These do not enter into the sensation of tickling, nor are they connected with it, *until* they have been associated with that particular sensation.

50. The old dictum that the eye cannot see itself seeing, assures us that we cannot at one and the same time assume the objective and subjective attitude; nevertheless a science of Vision has been possible, and a science of Psychology has disclosed the fundamental antithesis of object and subject as the twofold aspect of one fact. Extension, Solidity, Resistance, Colour, Heat, Light, Sound, &c., are recognised as objective aspects of Feeling. Motion likewise is one objective aspect of Feeling. If with a stick I draw a curve upon a wall, the motion of that curved line is a feeling projected outside me, and appears to be felt there. Now, without pausing to enumerate the various feelings condensed in these objects, "stick," "I," "curve," and "wall," let us merely ask, What does "There" mean?

It means blended feelings of sight, touch, and muscular movements. In feeling the curve there, I have a succession of sensations, which in their objective aspect is the motion of the curve drawn. Again, I see a rocket rushing up into the sky, turning and scattering into a rain of luminous drops. What moved *there* was felt *here:* that motion was my feeling; at each point in its curve the rocket touched my retina, and traced its course in Feeling, just as I traced the curve on the wall with my stick. The touch of the rocket was that of an ethereal point, the front of a wave, itself the end of the long line of the ray; but however delicate this line of communication between the oscillating molecules of the rocket and my retina, it was not less material than the stick between my hand and the wall, and its motion was the impulse to the molecular movements of my retina.

51. That the preceding exposition will be received with hesitation and incredulity, opposed as it is to the teaching of all authoritative writers, is probable, and mainly for these reasons: First, The traditional tendency of *postulating the existence of something more in a phenomenon than the phenomenon itself*, something more than its objective and subjective aspects. Secondly, The traditional mistake of assuming that a cause is something different from the co-operant conditions, and something different from its effect. Thirdly, The ineradicable difference between what is meant by the word Motion, and what is meant by the word Feeling.

52. Even Mr Spencer, who has with great lucidity expounded the evidence for the belief that "mind and nervous action are the objective and subjective faces of the same thing," insists that "we are utterly in-

capable of seeing, and even of imagining, how the two are related. Mind still continues to us a something without any kinship to other things."* There is an equivocalness in first declaring them to be two aspects of the same thing, and then pronouncing their relation to be inconceivable, and their kinship also inconceivable. Since the relation is conceived and expressed, it cannot be inconceivable; and since the two aspects are said to have one foundation, their kinship is assigned. What is meant is, that we are unable to imagine why one aspect is the obverse of the other: which may be said of all relations. The asserted relation may be questioned; but once accepted, the question *why* it is *what* it is, seems idle.

As to the kinship of Mind with other things, we must settle the meaning which the phrase may express. That Mind is *sui generis*, distinguishable from all physical phenomena, and thereby set apart as if alien from them, no one disputes. It is to explain this speciality that the hypothesis of a spiritual substance is invented. Mr Spencer rejects the hypothesis, but he replaces it by the hypothesis of an Unknowable Force. Should we grant this postulated "substance of mind," it would lead irresistibly to the conclusion that Mind *had* a kinship with other things, since this unknowable force is said to be the same as that of which all things are the manifestations. No one but a spiritualist will deny the kinship of Sensibility with Vitality, and of Vitality with the forces of inorganic matter, however distinguishable as a phenomenon. Mind, indeed, as the abstract symbol of all the complex phenomena of Sensibility, is unlike any one of its

* SPENCER: *Psychology*, i. 140.

concretes. Not being a thing, but a symbol, it cannot be said to have kinship with things. But each concrete fact of Sensibility has an inalienable kinship with all other things, if we view it, as we view them, from the objective side, for it is then a group of nervous tremors. Mr Spencer, however, anxious to bring prominently forward the consideration of the Unknowable Force, argues that "if we could succeed in proving Mind to consist of homogeneous units of feeling or nervous shocks, we should still be unable to say what Mind is;" and in his sense this is indisputable. Nevertheless I cannot but maintain that we should be able to say what Mind is, directly we had proved in what it consists; nor will the postulated Unknowable render this knowledge less certain.

"Existence," he says, "means nothing more than persistence; and hence in Mind, that which persists in spite of all changes, and maintains the unity of the aggregate in defiance of all attempts to divide it, is that of which existence in the full sense of the word must be predicated, that which we must postulate as the substance of Mind in contradistinction to the varying forms it assumes." Is not this substantialising an abstraction, converting the logical subject into an entity, distinguishing the abstract symbol, Mind, from all its concrete significates, and personifying it as the Real, of which they are simply passing forms? By a similar argumentation it might be said that "We can never know what a Nation is, even although we may have learned all its constituents, families, and individuals, all its institutions, its social and political relations, &c., since these are but modifications or particular manifestations of the underlying Nation,

which is in itself incapable of being known. It is this Noumenal Nation which exists in the full sense of the word, since it is this alone which persists through all the changes of social and political forms, surviving amid the incessant births and deaths of its individual members." Who will say this?

53. The postulated Unknowable, therefore, may be eliminated from the present inquiry, since its admission will not disturb any positive knowledge we may have reached. Nor does the impossibility of imagining how a nervous shock can *become* a feeling disturb the certainty of our knowledge that the one is the objective aspect of the other. The phenomenon known objectively as a nervous tremor, a neural process involving very complex elements of molecular energy, does not *become* a feeling in the sentient organism, it *is* that feeling in the organism, and is the occasion of a quite different feeling in the observer.

54. The supposed unlikeness of effect and cause is adduced in the utter want of resemblance between the feeling and the motion said to have produced it. That a sensation of colour is utterly unlike a rhythmic succession of ethereal waves, said to cause it, will not be disputed. The two phenomena are two, not one; just as the pressure of a finger on the trigger and the explosion of the gunpowder are two phenomena, not one. For the sensation of colour there is required not only the rhythmic pulses of the ether, but the co-operation of the optical apparatus, together with the propagation of the stimulation to the brain, where certain changes are effected, the sum of which is this particular sensation. Now this product of all the co-operant factors is no more like the ethereal waves than the wounded bird is

like the pressed trigger. In each case we have isolated one among the several co-operants, and named it the cause; what wonder, then, that the final product, which we name effect, is unlike this cause? In like manner, when we isolate the neural process as a molecular movement, apart from all vital conditions—that is to say, regard it in the light of a physical phenomenon in a circumscribed sphere—and suppose the impression on a sensory nerve to be the cause of a sensation, what wonder if the causal nexus is obscure? Such isolation would render any physical phenomenon unintelligible. If we regard the pressure on the trigger and the ignition of the gunpowder as the causes of the explosion and the causes of the fall of the bird, it is on the implied understanding that all the requisite conditions are present. Were the atmospheric pressure greatly lessened or increased, there would be no such explosion; were the gunpowder damp, there would be no such explosion; were the composition of the powder slightly different, there would be no ignition. Therefore, when we speak of a neural process as the objective side of a sentient process, we always imply the presence of all the requisite vital conditions; for the sentient process, although analytically assigned to the molecular changes in the nerve centres, is synthetically the *reaction of the whole organism.* We can no more suppose that a movement propagated through a nerve centre will alone, and isolated from the vital conditions of Sensibility, produce a sensation, than that a bird will fall wounded to the ground when some grains of gunpowder have been greatly agitated. Those who separate cause from effect as antecedent and consequent, and consider the wound of the bird to be the

effect of the exploded powder, may likewise consider the sensation of sound to be the effect, and the pulses of air its cause, or may consider the molecular movement of the auditory nerve as the effect of the air movement and the cause of the sensation. Thus conceived, the unlikeness of the one to the other is glaring. The sensation of sound is not the movement of the air, why then should it be like that movement? We might as well demand that an electro-plated spoon should resemble the electrolysis which is said to cause it. The auditory nerve is agitated by the air movement, and this agitation is the origin of a neural process, which is subjectively a sentient process. Because the sensation is unlike the external movement which originated it, the objection is urged that no equation can be established between Motion and Feeling, nor can a sensation be reconverted into any equivalent chemical or physical energy. It is this misleading conception of causation which sustains the spiritualist hypothesis, and obliges other thinkers to invoke some special mystery. Even Mr Spencer, after affirming that "the conditions essential to the production of nervous action are essential to the production of feeling," maintains that feeling and nervous action are wholly without community. But since he does not admit a spirit, ψυχὴ, among the conditions, I am at a loss to follow his reasoning, unless the popular view of causation be adopted, and the effect be regarded not as the incorporation of the co-operant conditions, but as the consequent of some remote antecedent; and even then it seems to me that the links in the chain would establish a community between effect and cause, so that we could not properly speak of some mysterious

way in which nervous action causes a feeling, and yet deny the community of the two.

55. A feeling is a change in the state of the sentient organism, which, although initiated by some external change (conceived as motion), is not to be regarded simply as the equivalent of the motion which *initiates*, but of the *whole neural process set in action*. No one will dispute the assertion that "although internal feeling habitually depends on external agent, yet there is no likeness between them either in kind or degree,"—because here the external agent is one feeling regarded objectively, and the internal feeling is *another* regarded subjectively; and when this external agent is said to produce a different feeling from that of our perception of it, by initiating changes in our consciousness, this is explicable as the sequence of feelings, one group of which is objective, the other subjective. I see a stone moving: this objective aspect has its correlative subjective aspect: the *cognitum* and its *cognitio* are not two facts, but one fact. This moving stone is seen to come in contact with my foot: here also objective and subjective coincide, and the successive positions of the object in Space have had successive and corresponding sequences in Consciousness; but immediately after contact I have the very different feelings of pain in my foot, and of muscular contraction in my jerked leg. These, which are said to be the effects of the blow, are then pronounced to be so unlike their cause—the feelings of pain and muscular contraction are so obviously unlike the motion of a stone—that no community can be predicated of them. But who does not recognise here the introduction of new factors? The moving stone,

i.e., the changing positions of the object, which to the visual sense had one form, has now been brought into relation with another sense, and the product is other. Instead of feeling the object with my eye, I am feeling it with my foot. And if I explain the change in the sensory nerve of the foot as a molecular movement, I bring it under the same objective head as the visible movement of the stone, or the inferred molecular movement of my optic tract; that is to say, I range the different feelings under the one symbol which expresses their objective aspect. So long as I preserve the purely subjective attitude, my feeling of pain is only distinguished from my feeling of the moving stone as one feeling from another; they differ as a taste from a scent, a touch from a sound. But when I regard the moving stone objectively, it is as something outside me, independent of me, and therefore separated by a whole diameter of being from the pain which is in me. Nevertheless, investigation leads me to the belief that the moving stone is the indissoluble product of objective and subjective factors, changes in me, and changes in the not-me; it leads to the belief that the pain is also such a product of subjective and objective; and the objective factor is expressible in terms of Matter and Motion, *i.e.*, as movements in a nervous tissue, because these are the symbols in which all objective aspects are scientifically expressed. The movements of the stone are seen, the movements of the nervous tissue are inferred, and are inferred because the invisible is translated into terms of the visible. Hence, while the logical disparity between Object and Subject, or Motion and Feeling, is wide

and irremovable, the real parity lies in their being both modes of Feeling.

I do not mean this in the idealistic sense. I simply mean that Feeling is our ultimate : it is that in which all knowledge begins and terminates. We can express all phenomena whatever only in its terms, for whether these phenomena are objective or subjective, they are, in a last analysis, seen to be forms of Feeling ; and the remote abstractions of Matter, Motion, Space, and Time, are symbols of sensible concretes. If it is true that we find running throughout all the modes of Feeling the abiding antithesis which is abstracted in our conception of Object and Subject, it is not less true that, since we can never divest the Object of its correlative Subject, we only know it as it appears in Feeling, because *that* is its mode of existence under those relations.

56. Does it not follow that Feeling is the much sought *Thing in itself*—the ultimate of search ? All things can be reduced to it ; but it can be referred to nothing more general. For if we say that Feeling is Change, and is distinguishable from Cosmic Change in that it is a special and seriated group of changes in an organism, we have still to invoke Feeling before we can render Change itself intelligible. But not to diverge further at present from our line of exposition, let us return to the admitted opposition of aspects, and the consequent impropriety of applying the terms which express the one to express the other.

57. It is, for example, absurd to speak of Feeling as Motion, and of Mind as extended, and therefore needing a "seat," a *locus*, in the brain or elsewhere; equally so to speak of Mind as a force, acting, reacting, &c. ;

absurd, *unless* we presuppose the identity of existence under diversity of aspects, and employ one aspect as the equivalent of the other. Thus it would be absurd to speak of the contraction of the muscles as the force which moves the limbs, unless the term contraction were understood to be the equivalent of the muscles in their dynamic state; the force *is* the contracting muscles, not the abstract contraction. So with mental force: it is the mass acceleration of the organs involved; but we happen to be more interested in the mental aspect of the phenomenon, or more familiar with it, and we therefore express it in this way. Mind acts on Body, and Body on Mind: these are intelligible expressions of familiar facts, and no harm comes from them so long as we understand what are the concretes these abstractions involve. In point of fact, few of us do know, and still fewer keep steadily in mind, the metaphorical use of terms of force in such cases, and hence the mystery of how Mind can act on Body may well have perplexed those who failed to see that Mind in their sense cannot act at all. The actions attributed to Mind are the actions of one part of the organism on another, and are not possible in the absence of these parts, nor in an unsuitable condition of the parts. When we say that a sensation determines an acceleration of the pulse or an arrest of a secretion, it is, 1°, either that we express the facts we know in the terms which are most intelgible; or, 2°, supposing that we have learned something of the physiological processes, and know that it is a particular neural process which acted on the muscles of the heart to produce the acceleration of its movements, or on the gland to arrest its molecular

movements, we nevertheless employ the familiar term *sensation* in lieu of neural process, although both terms express the same fact under its different aspects.

58. On the one hand are people puzzling themselves with the mystery of how Mind can act on Matter which is utterly alien to it; on the other hand there are those denouncing the use of the familiar expressions which seem to countenance the idea that Mind can act on Matter—declaring it to be monstrous to speak of an action prompted by and guided by Feeling,—as if a mental state could be a physical cause. And the denunciation is deserved, if directed against the popular notion of Feeling as something which is not the subjective aspect of a neural process; it is, however, only on such grounds that the familiar phrases are objectionable. Let the twofold aspect be once recognised, and there will be obvious advantages in preserving the familiar phrases. Thus, I see a flower, and thereupon arises the desire to pluck it. I stretch forth my arm, but before completing the intended action, the thought arises that perhaps the flower will give me more pleasure if left where it is; my arm is arrested. This succession I may describe in psychological or in physiological language. I may say that the action was prompted by a desire and arrested by a volition; or I may say that a stimulus of my optic tract caused an excitation of my brain, and a discharge from one group of cells upon a group of motor nerves, which set certain muscles in contraction, but before all the innervated muscles could complete their contraction, an inhibitory discharge from another group of brain-cells

caused an arrest. These are two very different descriptions of one and the same fact. The one is expressed in terms of Feeling, the other in terms of Matter and Motion. The one is universally intelligible, because its terms are those of universal experience; the other is only intelligible to those acquainted with the present state of physiological research, and is expressed not only in hypothetical terms, but in terms of an hypothesis which to-morrow may seem absurd. We should therefore be very irrational were we to relinquish the terms which are universally intelligible, and which can never by any advance of science become inaccurate. All we have to guard against is the tendency to mistake difference of aspect for difference of process, and to suppose that changes in Feeling can exist independently of changes in the organism, or that any change in the organism can be effected otherwise than by some previous change. Dissociate Feeling from Neural Process, and thus make a logical distinction the equivalent of a real distinction, and it will be misleading to speak of actions prompted by and guided by feelings. Identify Feeling with Neural Process, and popular language is justified, at the same time that the old mystery of the mutual action of Mind and Body is dispelled.

No experiences are more familiar than those which assign some actions to the influence of volition and others in despite of volition. If you are pushed down-stairs, you are distinctly conscious that your descent is neither prompted by nor guided by any feelings of yours; whereas you are distinctly conscious of such feelings when you walk down-stairs.

It is to express such distinctions that some actions are said to be prompted by feeling, and others not; and unless the purpose of our speech be that of describing the purely physical aspect, we naturally employ psychological terms; nay, even when we are attempting a description of the physiological sequence, it will often occur that our uncertainty respecting some of the physiological links in the chain will force us to express these in the intelligible terms of Feeling.

The reader may have observed that throughout I have employed the general term Neural Process, rather than name any particular process in a definitely assigned part of the nervous system; and this because the correlation of a sentient process and a neural process is a fact which I think admits of no question, whereas any specification of the process may be questionable, and, in the present state of science, is eminently so; on the other hand, however we may question the physiological explanation of a particular sequence, we cannot question the psychological explanation which says that a certain sensation preceded and a certain sensation accompanied the sequence. The mechanism by which I was induced and enabled to walk down-stairs may be imperfectly known to me, but there is no obscurity whatever in my knowledge of the feeling which preceded and the feeling which guided the action. Consequently, while there is both difficulty and uncertainty in expressing this action in mechanical terms, there is none in expressing it in psychological terms. I do not very certainly know how to reach the nervous mechanism and set it in action, but I do know how the action may be set going by raising a desire which may determine a voli-

tion; nor will any advance of physiological knowledge render the popular modes of expression less exact, nor less intelligible.

59. The view propounded in this chapter being novel, I cannot expect even the sympathetic reader not to be arrested by many difficulties which its application will present. I have had to examine many for myself before finally adopting it; but as they all disappeared after attentive consideration, I must trust to the thoughtful meditation of each reader to dispel the obscurities as they arise. Since it would occupy more space than can here be given were an attempt to be made to forestall the many objections which may occur to a reflective mind, I will only touch on two objections which may be answered very briefly.

First objection: Motion must be something more truly characteristic of external phenomena than any other mode of Feeling, since by it we are enabled to explain them universally, and find our dynamical explanations all verified. It is not by Touch, Taste, Hearing, Smelling, Musculation, &c., that we can explain astronomical, physical, chemical, and biological phenomena; nor is it conceivable that, were the external a continuum of smells and touches, or of tastes and touches, or of smells, tastes, and touches, we should ever have acquired that vast and accurate knowledge which is expressed in terms of Motion.

Answer: The greater range of visual experiences implies that Motion will form a much larger part of objective experience, and because it thus predominates we translate all other experiences into its terms.

Whenever we think of any experience objectively, we suppose ourselves looking at it. Although we believe that odours have objective conditions which are not *odours* unless they are smelt, we can only picture these conditions apart from the organ of smell as molecular motions, because in stripping them of the peculiar character with which one sense clothes them, we are forced to clothe them with some other sensible character; and as we imagine ourselves seeing them, we clothe them in the form of Motion, which is the most general form of visual experience. It is Motion, and not Colour, which predominates, and this because although we cannot see or imagine anything which is not coloured, yet the feeling of Colour is eminently variable, whereas the feeling of Motion is constant.

60. Second objection: The sentient process is said to be only the subjective aspect of the neural process, yet no one disputes the fact that many neural processes take place without any consciousness of corresponding feelings. Are there not actions incessantly going on in the organism, which, although shown to be consequent on nervous stimulation, are nevertheless entirely unconscious, although at other times these same actions are accompanied by consciousness?

Answer: This difficulty arises from not clearly recognising the generality of the term Neural Process. Each particular feeling—state of consciousness—is the subjective aspect of its particular neural process. If the rapid ignition of dry wood is different from the smouldering of damp wood, we do not suppose the elements to have been the *same* in each case, although the general term Combustion properly applies to each.

In like manner, if a sentient organism responds to a particular stimulus, now in one way and now in another, it is obvious that, although the general term Neural Process applies to both, there have been different elements at work in each.

Although analysis resolves a perception into elementary sensations, and a sensation into elementary units (neural tremors), each unit is *sensible*, just as each of the letters into which a word is analysed is *vocal;* but each unit, though sensible, is not a sensation, for a sensation is a process grouping units. The fact that a stimulation must reach a certain intensity before it is a feeling, and that henceforth this feeling increases in a constant ratio with the increase of the stimulus, to vanish abruptly when a certain limit is reached, proves that there must be molecular movements in the tissue which are not grouped into processes, and this both before a sensation emerges, and after it has vanished. Nevertheless, all these movements in the tissue are neural tremors, and therefore sensible units, whether grouped and seriated into processes as states of Consciousness and states of Subconsciousness, or not grouped, but passing away in Unconsciousness. They are one and all to be classed under that general mode of nervous activity which is called Sensibility. Fechner has noticed the paradox of Consciousness said to emerge from an integration of unconscious states—which to many minds seems like the arising of something out of a summation of nothings ; but, as he remarks, if this is a puzzle to the metaphysician, the mathematician feels quite at ease with it, whence we may conclude that the mathematical point of view is the true one.* Suppose

* FECHNER: *Psychophysik*, ii. 246.

y to be a function of x—or a feeling to be a function of a stimulation—then as the value of x decreases, the value of y decreases, and at a certain point the value of y may become zero, or have passed into a negative quantity, while x still remains a positive; that is to say, the feeling vanishes when the stimulation has decreased to a certain point, although the stimulus may still be operant: a sound, which is a function of the distance, becomes fainter and fainter as the distance increases, till it finally disappears, although the aerial pulses still beat on the tympanum. We have only to increase the value of x, and at once y has again a positive value; the lowered rapidity of the aerial pulses has only to be raised, and the Sensibility which before was too feeble for Consciousness, again emerges into sensation. There are certain limits between which neural tremors are fused into neural processes, and emerge in Consciousness; *beyond* these limits, on either side, there is no sensation, only sensible units. The same may be said of Consciousness itself, as the general stream of seriated sensibilities arising in all parts of the organism: it has its *subconscious* states, which are to its full blaze of light what the dawn and gloaming are to the day, or what the impressions on the outer circles of the retina are to the yellow spot of distinct vision.

61. The imperfect discrimination between Sensibility and Consciousness is a source of much perplexity. Because there are actions which take place unconsciously under some conditions, and consciously under others, it is held that the former are purely physical and mechanical, the latter only psychological.

But the truth is, that both are physical from the physiological side, and both are psychological as involving Sensibility, *i.e.*, those actions in which the sentient mechanism plays a part. To deny their psychological character because they are involuntary and unconscious, would lead to the monstrous conclusion that trains of thought are not psychological phenomena, since these also frequently pass without consciousness, and always without volition. A judgment is not less automatic than a breathing; and the several links in a train of thought are often so hidden in the subconscious region that we entirely fail in the endeavour to drag them into the clear light. But all the functional activities of the sensitive organism, whether they are unconscious, subconscious, or conscious, have the one character of Sensibility, and as such belong to Psychology. They vary with the varying neural processes; they are all functional activities of nerve-tissue; but the fibres and cells in action, and the energy with which they act, differ in each case. The spiritualist may say that when an action takes place unconsciously the nervous mechanism has been excited, but the spirit has not responded. The biologist will say that the nervous mechanism has been excited in a different way, and that other parts have been involved than would be involved were the action accompanied by consciousness. To perceive an object or to think of an event is obviously a different mental and physical process from that of reflecting on it, attending to it, being conscious of it.

62. We may now condense the various arguments of this chapter in a single statement. Existence—the

Absolute—is known to us in Feeling, which in its most abstract expression is Change, external and internal. The external changes are symbolised as Motion, because that is the mode of Feeling into which all others are translated when objectively considered: objective consideration being the attitude of *looking at* the phenomena, whereas subjective consideration is the attitude of any other sensible response, so that the phenomena are different to the different senses. There is no real break in the continuity of Existence; all its modes are but differentiations. We cannot suppose the physical organism and its functions to be other than integrant parts of the Cosmos from which it is formally differentiated; nor can we suppose the psychical organism and its functions to be other than integrant parts of this physical organism from which it is ideally separated. Out of the infinite modes of Existence a group is segregated, and a planet assumes individual form; out of the infinite modes of this planetary existence smaller groups are segregated in crystals, organisms, societies, nations. Each group is a special system, having forces peculiar to it, although in unbroken continuity with the forces of all other systems. Out of the forces of the animal organism a special group is segregated in the nervous mechanism, which has its own laws. If ideally we contrast any two of these groups—a planet with an organism, or an organism with a nervous mechanism—their great unlikeness seems to forbid identification. They are indeed different, but only because they have been differentiated. Yet they are identical, under a more general aspect. In like manner, if we contrast the world of Sensation and Appe-

tites with the world of Conscience and its Moral Ideals, the unlikeness is striking. Yet we have every ground for believing that Conscience is evolved from Sensation, and that Moral Ideals are evolved from Appetites; and thus we connect the highest mental phenomena with vital Sensibility, Sensibility with molecular changes in the organism, and these with changes in the Cosmos.

This unification of all the modes of Existence, by no means obliterates the distinction of modes, nor the necessity of understanding the special characters of each. Mind remains Mind, and is essentially opposed to Matter, in spite of their identity in the Absolute; just as Pain is not Pleasure, nor Colour either Heat or Taste, in spite of their identity in Feeling. The logical distinctions represent real differentiations, but not distinct existents. If we recognise the One in the Many, we do not thereby refuse to admit the Many in the One.

L'ENVOY.

The purpose of these volumes has been to lay down the Foundations of a Creed, by exhibiting the Method which determines all successful inquiry, and by specifying certain general results reached on that Method. The results may be questioned or rejected without any discredit to the Method. I have attempted to draw the lines *within* which metaphysical no less than physical discussion may profitably be conducted, and each question may be placed on that narrow ground on which alone Verification is possible. This attempt, I venture to hope, has been successful. I am less confident as to any one of the solutions proposed: the advancing movement of Science forbids the notion of finality. Still less confident am I as to their general acceptance by my contemporaries: for since I am not always satisfied with the solutions confidently announced by them, it would be unreasonable to expect that they will be always satisfied with mine. Nor, indeed, at my age, whatever confidence a man might feel in the ultimate triumph of certain views, ought he to expect to convert those of his contemporaries, who have already formed their habits of thought, and crystallised their experiences into doctrines. His only rational hope is in the younger generation; and in that generation only in the small circle of students who, by previous culture and native disposition, have been prepared for a sympathetic attitude. These are

the conditions which determine the acceptance of new truths; and native disposition is quite as important as previous culture: unless the attitude of mind be sympathetic, there will be stubborn resistance to what otherwise would be clearest evidence.

APPENDIX.

A.

IMAGINARY GEOMETRY AND THE TRUTH OF AXIOMS.

B.

LAGRANGE AND HEGEL: THE SPECULATIVE METHOD.

C.

ACTION AT A DISTANCE.

APPENDIX.

A.

IMAGINARY GEOMETRY AND THE TRUTH OF AXIOMS.

In a previous chapter (vol. i. p. 384) Axioms were disclosed to be experiential in origin and in range. They also, therefore, must be accepted, like all other truths, as equations, the terms of which are Facts and Feelings. To a similar result tend the speculations of those ingenious geometers who have constructed an Imaginary Geometry, which would be rigorously true for an *imaginary* space, although not true of *real* space: true, if their postulates are granted, and our postulates and intuitions are disregarded.

Disregard of Intuition and Sensible Experience renders all speculations imaginary; but although these particular geometric speculations have no more real validity than the fictions of Laputa, they have a speculative value, especially in reinforcing the experiential doctrine; for, as M. Houël, the translator of Lobatschewsky, remarks, "they throw into the region of chimeras the hope still entertained by many that it is possible to demonstrate the axiom of Euclid respecting parallels otherwise than through Experience" * —a result devoutly to be wished, when we find the desire for *à priori* demonstration carried so far as it is by those who object that Euclid does not *prove* that a straight line can be drawn.

It must assuredly shake the confidence of the *à priori* school to find a thinker so illustrious as Helmholtz arguing that the Axioms of Geometry are not universally true, not necessarily true, not in any sense to be taken as absolute; to find geometers like Gauss, Lobatschewsky, Beltrami, and others, constructing parallels which

* Lobatschewsky: *Études Géométriques sur la Théorie des Parallèles*, Paris, 1866.

must meet when produced; to find geometers like Sylvester and Clifford suggesting a geometry of four dimensions; and to read grave propositions asserting that the three angles of a right-angled triangle are not necessarily equal to two right angles. Such a complete upsetting of the foundations by men so eminent, cannot be doffed aside as idle paradoxes of perverse ingenuity. They demand a careful scrutiny, which may perhaps greatly enlighten us as to the principles of Certitude in Mathematics and elsewhere.

In a remarkable essay* Helmholtz argued that, however applicable to the only Space known to us, the Axioms would be superseded by others in a Space of two or a Space of four dimensions. He admits that our geometry is true for all beings living in a Space of three dimensions. But this truth is purely relative to such Space. We must not universalise it, and assume it to be equally applicable to all Space whatever; for we can conceive conditions under which it would *not* be true. That is to say, unless we undertake to affirm that Space must *necessarily* be of three dimensions, and only three—and who can affirm this?—we can conceive that in other universes there may be intelligent beings living in a Space of two or more dimensions. If, says Helmholtz, these beings lived in a Space of two dimensions, and lived *in* the surface of a sphere, or pseudo-spherical saddle-shaped surface, many of our Axioms would not be true. These beings would legitimately deny much of our Geometry. They would deny all theorems based on the Axiom that two shortest lines cannot intersect in more than one point. *They could indeed entertain no such notion as that of parallel lines*, since all the shortest lines of the Space known to them would intersect when produced. With them the angles of a triangle would always, more or less, exceed two rights.

There is some ambiguity in his language which does not, I feel sure, extend to his meaning. When he says that beings living in a Space of constant curvature would deny Euclid's Geometry to be true, he means, I think, that there those theorems would not be *applicable*, because the requisite intuitions were not given; but, on the contrary, the intuitions would be different because the Space was different. Obviously if we assume the existence of a Space unlike that to which our Geometry applies, we must assume intuitions unlike those which our Geometry formulates. It is indisput-

* *Academy* vol. i. p. 128.

able that propositions which are true under one set of conditions must be false under another set of conditions. But note here the common fallacy of supposing that a truth which formulates given conditions can be rendered doubtful by admitting the possibility of the conditions being *elsewhere* different. The new truth formulating different conditions cannot invalidate the truth formulating similar conditions. The truths of plane Geometry are not affected by the truths of spherical Geometry; nor would the Geometry of three dimensions be a whit less true if we constructed a Geometry of n dimensions. The fallacy here combated is the same as that which throws doubt on the absolute certainty of relative Truth, and proclaims that nothing can be certainly known because all things cannot be known.

The question raised by Helmholtz may profitably induce the student not only to reconsider the logical foundation of mathematical truths, but also to meditate on the speculation advanced by Reid in the ninth section of Chapter vi. of his *Inquiry*—a speculation which has been so entirely disregarded, that his editor, Hamilton, passes it over without a note. It is called the "Geometry of Visibles," and endeavours to show what would be the consequences of dealing with visible figure unassisted by tangible figure, were the eye placed in the centre of a sphere. The assumption is quite as permissible as the assumption of a saddle-shaped space; and the consequences are rigorously deduced. The fiction which suppresses our real intuitions, and substitutes for them what *would be* the intuitions possible under unlike conditions, generates an Imaginary Geometry. Every great circle of the sphere in which the eye is a centre will have the appearance of a straight line; for the curvature of the circle, being turned directly towards the eye, will not be perceived by it. For the same reason any line drawn in the plane of a great circle of the sphere will appear straight, whether it be in reality straight or curved.

I cannot, as I should wish, quote the whole of Reid's exposition, to which, since it is easily accessible, the reader can turn for himself. I will here only note, that he mathematically deduces the conclusions, that the visible angle comprehended under two visible right lines is equal to the spherical angle comprehended under the two great circles which are the representatives of these visible lines—in a word, that a plane triangle is the same in every respect as a spherical triangle—that any two right lines being produced, will

meet in two points and bisect each other, and that if two lines be parallel, that is, everywhere equally distant from each other, they cannot both be straight.

The resemblance of these results to those propounded by Helmholtz is apparent. The fallacy seems to me to lurk in the substitution of terms. Reid supposes that any line drawn in the plane of a great circle will *appear* straight to the eye, whether it *be* straight or curved. But Geometry is concerned with its own constructions, not with what the elements of such constructions may be elsewhere. Either the geometer of this imaginary space has, or has not, the constructions of a right-lined and a spherical triangle. If he has such figures, they are not identical, and his intuitions of them are never the same. If he cannot see what to us is a *curve* otherwise than as a straight line, he cannot construct a triangle otherwise than by straight lines. Because a tower appears cylindrical to one spectator, and square to another, the *geometric properties* of the cylinder and the square are not supposed to be the same; nor will any rectification which shows that each of these forms is relative, and that neither represents what the tower is in *other* relations, affect the geometrical question. But Reid, while placing his geometer, in an imaginary position, supposes at the same time that the geometer has the conceptions impossible under such conditions, and already knows the difference between plane and spherical triangles. Let this be so; let the imaginary geometer be able to draw straight lines and curves, he will then see the differences between a spherical and a plane triangle, although under some positions the spherical may to his eye be indistinguishable from the plane. Whether in any particular case a tangible body which appears right lined is *really* curved, *i.e.*, is curved to other eyes or in other positions, is not a question of Geometry at all.

Professor Jevons, eminent both as mathematician and logician, published a reply to Helmholtz's essay,* and undertook to show that even in a spherical Space wherein the *figures* of plane Geometry could not exist, the *principles* of plane Geometry might be developed by human intellects, precisely as human intellects have been able in our Space of three dimensions to develop the principles of a Geometry of four dimensions. "Euclid's elements would be neither more nor less true in one such world than another; they

* *Nature*, vol. iv. p. 481.

would only be more or less applicable." A further development of this position was given by Mr J. L. Tupper in the same periodical (vol. v. p. 202). Helmholtz replied to Professor Jevons,* and while agreeing in the proposition that beings living in a Space of two dimensions might, if they studied infinitely small figures, apply to them the same theorems which Euclid has laid down for figures of every magnitude, proposed the following answer :—

"In the first place, it is evident that it is not the same thing whether Euclid's theorems be true only under very limited conditions, or for all Space without exception. The Geometry of infinitely small figures would be of great importance in discovering a system identical in form with that of Euclid, but truths applicable to figures of infinitely small dimensions only could not be considered as necessary truths or axioms of Geometry in general. But as we, living (at least as far as we know) in Space fulfilling the postulates of Euclidean Geometry, can develop analytically the system of pseudo-spherical Geometry of any number of dimensions, so beings living in a pseudo-spherical Space could *invent analytically* the system of Euclidean Geometry as relating to an imaginary Space not accessible to their experience; and perhaps they would find that the calculation of the geometrical quantities of their own Space would become more simple or more symmetrical by introducing the system of variables belonging to a Space of more dimensions, as we sometimes introduce a fourth co-ordinate into the equations of lines and surfaces in order to get homogeneous expressions, which we even differentiate with respect to this superadded variable. Our mathematicians, moreover, speak of imaginary lines and points of intersection (of two ellipsoids for instance), and their imaginary co-ordinates, as if such imaginary dimensions really existed; and they do this to preserve analogy and homogeneity in the analytical expressions. But for all this, no mathematician ever came to the conclusion that a fourth dimension of Space exists, even though he finds it convenient to write his equations as if it existed. And I cannot see why the mathematical intellects of a spherical world should come to another conclusion, even if they should discover the simplification of their analytical Geometry which they could devise from the introduction of the co-ordinates of a Space of more dimensions. Points and lines in such a Space would have no more

* *Academy*, vol. iii. p. 52.

meaning to them than length in the direction of the fourth co-ordinate can have for us, although we introduce such a co-ordinate into our calculation."

The reader's attention is called to two considerations, which I have endeavoured to make clear in previous parts of this work. First, That no truth can be extended beyond its formulated terms; and in this sense every truth is limited to the specified conditions, and can be universal only on the universalisation of such conditions; also that in this sense every truth is necessary. Secondly, That it is a grave error to suppose Geometry, or any other science, is simply deductive, and can be developed from axioms and definitions without regard to intuitions; whence it follows that unless we have sensible intuitions of the *figures*, there can be no rational *principles* reached; and any attempt to develop geometrical principles without intuitions can only be operations on symbols which have no assignable values. I shall have occasion presently to recur to these two points, and may now proceed with the examination of the debate between Helmholtz and Jevons.

The ground of their difference seems to lie in the ambiguity of the word Truth. Professor Jevons argues that the plane Geometry of beings in a spherical space would be true, though inapplicable. Helmholtz argues that it would not be true, because not in accordance with the realities of their experience. Professor Jevons maintains that "we are in exactly the same difficulty as the inhabitants of a spherical world. There is not one of the propositions of Euclid which we can verify empirically in this universe." I do not accept this statement, since I have shown that ideal constructions *are* verifiable by reduction of abstractions to their concretes, the symbols to the feelings symbolised, and inferences to sensations; and that since Euclid's propositions may be exhibited as equations of their terms, they are empirically verifiable. However exquisitely polished a real surface may be, we know that it is not an exact plane, and that the microscope would show us the irregularities; yet geometrical constructions of perfect accuracy can be made on such a surface—that is to say, they shall be accurate to Perception, which *sees* no imperfections on the surface, and accurate to Conception, which *admits* of no imperfections in its abstract surface. Professor Jevons continues—"I do not think that the geometers of the spherical world would be under any greater difficulties than our mathematicians are in developing a

science of mechanics, which is generally true only of infinitesimals. Similarly in all the other supposed universes, plane geometry would be approximately true in fact and exactly true in theory, which is all we can say of this universe. Where parallel lines could not exist of finite magnitude, they would be conceived as of infinitesimal magnitude; and the conception is no more abstruse than the direction of a continuous curve, which is never the same for any finite distance." He concludes that Helmholtz is guilty of an *ignoratio elenchi*, because while pointing out the possible existence of worlds where the Axioms of our Geometry would not apply, he appears to confuse this conclusion with the falsity of the axioms. Wherever lines are parallel, the axiom concerning parallel lines will be true; but if there be no parallel lines in existence, there is nothing of which the truth or falsity of the axiom can come in question.

Here we see how Truth has reference to the *import of terms.* If parallel lines are *supposed* to exist, the axiom will be true under those fictitious conditions: it will be an ideal truth; if they *really* exist, the axiom will be true in real application to them; but if, as in a space of constant curvature, there are *no* parallel lines, the axiom cannot be true of that space. Helmholtz replied that Mr Jevons did "not sufficiently distinguish between the truth which corresponds to reality, and analytical truth, which is derived from a hypothetical basis by a logical process consistent in itself, and leading to no contradiction. For us the Euclidean Geometry is true in reality: a theorem of the spherical or pseudo-spherical Geometry could be called true in the second sense, when consistent with the whole system of such a Geometry. For the intellects of a pseudo-spherical world, on the contrary, the Euclidean Geometry would be fictitious, and that of Lobatschewsky real." I should express the distinction thus: Truth is the equation of its terms; and when the terms have intuitions for their import, and objective reals as their basis, the equation expresses a *real truth;* when the terms are symbols, the import of which has no assignable intuitions, the equation expresses a *symbolical truth*, which can be rendered applicable, real, only by assigning real values. The *consistency* is absence of internal contradiction; and this consistency belongs to the Imaginary Geometry. This is what logicians call Formal Truth. But what is commonly understood as Truth is something more than this; it is the absence of external contradiction—*i.e.*, the equivalence of the signs and the

things signified, of feelings and facts, *i.e.*, of particular feelings and feelings registered as general.

The identification of Truth with Consistency is only permissible on the understanding that the consistency lies in the import of the terms, and the equivalence of the sign and the thing signified. Symbols may be operated on to any extent, but unless they are symbols having intuitions for their import, they can lead only to symbolical results, analytical truths—never to *real* results, *real* truths. Lobatschewsky would have doubtless admitted this, for he somewhere says, "J'ai taché de prouver que rien n'autorise *si ce ne sont les observations directes* de supposer dans un triangle rectiligne la somme des angles égale à deux droits, et que la géométrie n'en peut pas moins subsister, *sinon dans la nature du moins dans l'analyse*, lorsque l'on admet l'hypothèse de la somme des angles moindre que la demi-circonference du cercle."* In the purely analytical region, Consistency will be the equivalent of Truth in the region of Fact. Our sole care must be not to confound the two. But although I admit that the non-Euclidean Geometry may be thoroughly consistent, and ideally true—*i.e.*, within the sphere of its assumptions—I can neither admit the legitimacy of extending any of its conclusions beyond that sphere, nor the suggestion of Gauss and Helmholtz, that because we can conceive a Space in which its axioms would not be truths, the Euclidean Geometry is not *rigorous*,† not necessarily true. I maintain that every truth which is an equation of its terms is rigorous, whether those terms be interpretable as signs of sensations—*i.e.*, having objective reality, or as arbitrary symbols having merely a subjective value. The terms of Euclidean Geometry are interpretable as signs of sensations, and are intuitions of sensible experience; any equation of such terms must therefore be rigorously true, though limited to the import of such terms; nor will any substitution of other terms, or other import, affect the absolute truth of such equa-

* This passage I find quoted by DELBŒUF, probably from LOBATSCHEWSKY'S paper in *Crelle's Journal*. It is not in the work translated by HOUËL.

† "La Géométrie non-Euclidienne," says GAUSS, in his letter to SCHUMACHER, "ne renferme en elle rien de contradictoire, quoique, à première vue, beaucoup de ses résultats aient l'air de paradoxes. Ces contradictions apparentes doivent être regardées comme l'effet d'une illusion, due à l'habitude que nous avons prise de bonne heure de considérer la géométrie Euclidienne comme rigoureuse," p. 40. That is to say, we have been in the habit of considering the Space we know as the real Space; the new Geometry considers a Space different from that of Euclid.

tions—it will simply be the substitution of one proposition for another.

When I say that the terms are signs of sensible experiences, this must not be misunderstood as implying that Euclidean constructions are other than ideal representations of reality. Every one admits that all our constructions are approximations. No real circle absolutely corresponds with our definition. No real line is perfectly straight; no real surface is perfectly plane. When, therefore, modern geometers suggest that the sum of the three angles of a rectilinear triangle on a vastly magnified scale might not be exactly equal to two right angles, this is intelligible on two suppositions: first, that the homaloidal Space with which Geometry deals is in fact a curved Space, the curvature becoming sensible when very distant points are taken: in this case, although any triangle we have occasion to measure may be exactly equal to two rights, yet it is quite true that on an immensely larger scale there would be a sensible inequality, just as the more a curve is magnified the straighter it appears, but only to our unmagnified senses: for if our vision increases *pari passu* with the increase of the curve, no approach to straightness can result. In answer to this supposition, I should say that it is only made plausible through a silent substitution of one term for another; the Space which these geometers have in view is *not* the Space which common Geometry deals with. Respecting the second intelligible supposition, on which the three angles of a triangle may not be exactly equal to two rights, I can only conceive it to be the familiar truth that our constructions are but approximative as representations of reals. In the region of Abstraction, with which alone Geometry is concerned when formulating abstract equations, *the* triangle is of any size. That the angles of a quadrilateral are equal to four right angles is an identical proposition. That the quadrilateral, when divided by a diagonal, equals two triangles, and that the three angles of each of these triangles must be equal to two right angles, the half of four being two, are also identical propositions. In this ideal region no variation is admissible. Magnify the triangles as you please, the equation remains unaffected. Whereas in the region of concrete triangles there must always be some difference between the figure and our conception.

The Geometry founded on Intuition, and the Imaginary Geometry which is founded on Definition without regard to Intuition, may profitably be considered here. The immense extension of our re-

sources which has resulted from the introduction of new symbols in the case of Analytical Geometry, may probably have produced the illusion that, by means of symbols, something more than increased facility in calculation can be reached—in fact, that new symbols would give us a new space. When Descartes substituted algebraic symbols for geometric figures, and demonstrated geometric theorems by formulas of the co-ordinates x, y, z, these formulas constituted a new definition of Space, but did not give us a new Space. The co-ordinates were symbols, interpretable into sensations, and only because they were so interpretable could they be applied *in lieu* of the geometric figures. They were simply a new and more available mode of Notation, not a new thing noted. Whether we establish the properties of Space through intuitions of figures, as in Geometry, or through calculations of symbols which represent those intuitions, as in Analytic Geometry, the conception thus differently represented remains unaffected.

Attempts have been made of late to demonstrate a fourth dimension in Space; the wiser heads refuse to accept the fourth dimension as a reality, content to use it as an artifice of calculation. In this sense, taking it purely as an *auxiliary hypothesis*, it should be welcomed, directly it has been shown to fulfil the demands of such auxiliaries. And this appears to have been the case: Prof. Sylvester, Dr Salmon, and Prof. Clifford have thus legitimised it.* We have only to bear in mind that it is an artifice, and that the fourth dimension cannot be seen, nor touched, nor felt as movement—in a word, cannot be interpretable by Feeling. There will then be no equivoque. The caution is, however, greatly needed. The fact that something which is not possible, not even *imaginable*,—*e.g.*, an unlimited homogeneous surface—is analytically *conceivable* (*i.e.*, expressible in symbols), and the fact that Analysis is a potent instrument extending the range of Geometry as Conception extends the range of Perception—such facts have led to the belief that operations on symbols, even in disregard of intuitions, will conduct us to knowledge inaccessible to Feeling; and this is the analogue of Metempirics, which accepts conceptions destitute of sensible bases. No one denies that by means of analytical formulæ we are led to the discovery of new facts. The point here insisted on is that they require verification by Sense or Intuition

* See *Nature*, vol. i. p. 238.

before they can disclose the *existence* of new facts. The chemist may so manipulate chemical symbols as to be led to the discovery of hitherto unsuspected substances; but he has to verify the validity of his operation—he has to *find* the substances. Metaphysicians, when they suppose that if the mind of man can frame a conception there must exist some corresponding reality, would do well to ponder this distinction between operating on symbols and verifying the result of the operation.*

It has been argued that since we can imagine a Space of two dimensions, although this is unwarranted by Experience, we can also imagine a Space of four. This seems to me doubly fallacious. I deny that we can *imagine* (though we can *conceive*) a space of two dimensions; and even were such a Space imaginable, there would be an infinite distinction between it and the Space of four dimensions. To say that possibly there may be sentient beings for whom a third dimension does not exist, is very different from saying that we can imagine, *i.e.*, form an image of their space. By no effort can we *divest* ourselves of our intuitions, and form a mental picture of what the universe is to different intuitions. We can indeed symbolically construct a space of two divisions, simply by employing only the symbols of two, and dropping that of the third; as we can construct a geometric figure without attending to its solidity or its colour. By such artifices we can conceive, and reason about, the world of the blind; but we cannot picture it. Waiving this point, however, let us note how widely different is the case with a Space of four dimensions. It is obviously impossible to imagine this fourth, which, never having been present to Sense, cannot be revived in Imagination. The comparatively easy resource of dropping one part of our sensible experience, and attending only to the other two, is altogether different from the task of *adding* an entirely new sensible basis. A fourth dimension, then, must always remain an artifice, which cannot be interpreted in terms of sensible experience. We cannot imagine it, we cannot believe in it as a reality. To accept it on the faith of analytical operations, and to suppose that a manipulation of symbols without regard to sensible experience can lead to anything *more* than symbolical results, is like supposing that the imaginary creations of poets have a real existence in the sensible world. Genii compressible into bottles, and expansible into giants,

* See this point more fully developed in PROBLEM III. chap. vi.

can be written about and pictured, but they are not possible realities, which any fisherman may pull up in his net.

B.

LAGRANGE AND HEGEL: THE SPECULATIVE METHOD.

Our exposition of the limitations to which Deduction is confined carries with it a condemnation of the Method so dear to Metempirics. To complete the lesson, however, we should disengage the real efficiency of a procedure which, although often a failure, is sometimes a success; and to do this we must find out wherein the failure and the success will lie. Two great thinkers, Lagrange and Hegel, may profitably be contrasted as examples of the fertile and infertile employment of the Deductive Method.

In that wonderful achievement, the *Mécanique Analytique*, Lagrange proposed to himself the novel aim of "reducing the theory of Mechanics, and the art of resolving its problems, to general formulas, the simple development of which gives all the equations necessary for the solution of each problem." He proposed another aim, which was that of "uniting and presenting *under one point of view the different principles which had been found* to facilitate the solutions of the questions, *showing their connection and mutual dependence*, enabling us to judge of their correctness and their range." The single principle to which all the others were assigned as developments was the principle of Virtual Velocities. In the opinion of Laplace, this was to render the science perfect. "Il a réduit la recherche du mouvement d'un système quelconque de corps, à l'intégration des équations différentielles. Alors l'objet de la Mécanique est rempli, et c'est à l'analyse pure à achever la solution des problèmes." *

Hegel's aim was to reduce the theory of the Universe, and the solutions of various problems, to a single principle—namely, the dialectical movement of contradiction, in which one idea successively evolved another by union with its opposite. Being and its opposite Non-Being, passed from their abstractness into the

* Laplace, *Système du Monde*, i. 348.

concreteness of reality—*i.e.*, Becoming. Hegel brought the multiplicity of the Universe under this one rubric, as Lagrange had brought the multiplicity of Motion under his one rubric. The evolution was deductively expounded. Nor can it be said that Hegel's principle is more abstract, and his treatment more analytical, than Lagrange's. If his attempt was pure Metempirics, the attempt of Lagrange was pure Mathematics. If Hegel rejected the complexities of concrete perception and constructed the universe out of conceptions (*Begriffe*), Lagrange expressed the elementary dynamical relation in terms of the corresponding relations of pure quantities, and from the equation thus obtained deduced his final equations by simple algebra. Thus, although certain quantities which express the physical connections necessarily appear in the equations of motion of the component parts of a system, the method of Lagrange eliminates *these* quantities from the final equations, and retains simply the algebraical quantities. Nay, so resolute is he to keep to this abstraction, that he declines to call in the aid even of diagrams; fixing attention solely on the symbols, he banishes the ideas of velocity, momentum, and energy, *after they have once for all been condensed in the symbols.*

Strange as this procedure may appear to those who have not reflected on the ideal constructions of Science, it is but an extension of the principle of Analysis. Science deals primarily with abstractions. All the complexities of concretes are got rid of (when once their abstract values have been ascertained); and thus, in lieu of a mill-stream with its varied banks, "the dark round of the dripping wheel," and the complicated internal mechanism of the mill, Science substitutes *abstract numbers:* in it the reals disappear and give place to *foot-pounds.* So in dealing with the diffusion of gases, instead of attempting to follow the real process, the chemist, knowing that the diffusiveness depends on the relative densities of the gases, takes the square root of the number which represents the specific gravity, divides one by this number, and in the fraction thus obtained gets the diffusiveness. Hegel saw clearly enough the triviality of the common objection that Philosophy "deals only with abstractions;" and the common fallacy that therefore it deals only with empty generalities. Philosophy, as he says, moves only in the region of Thought, and therefore its contents are abstractions; but this is only as respects the form; in its elements

Philosophy is concrete."* I think he too often failed steadily to keep the concrete reality in view; but he was assuredly correct in defining Philosophy as the thoughtful contemplation of things—*die denkende Betrachtung der Gegenstände;* where he erred was in substituting the movement in thoughts as equivalent to the movement in things—operating on abstract symbols without regard to their concrete reals; a substitution which is perfectly legitimate when the symbols are the rational equivalents of reals, but wholly deceptive when this equivalence is not demonstrable.

It is because Hegel's Method only involves operation on symbols, and not the verification of their equivalence with reals (in this resembling the procedure of all Metempirics), that it conducts him to results flagrantly at variance with some of the best-ascertained truths of Science, and never in any single instance, I believe, conducts him to results which enlarge the store of positive knowledge, out of the purely logical region. Science owes nothing to Hegel's Method, but, on the contrary, has often been seriously retarded by it; whereas Science has been enriched by Lagrange. Hegel has with astonishing ingenuity and consistency ranged the Universe under his one rubric, classifying its phenomena into a system. But the reason why his classification has not the power manifested by Lagrange's, is not that he embraces the Universe—Lagrange only embracing Dynamics—but that his logic is uncontrolled by Verification. The defect is not simply in "constructing the universe out of conceptions," since in Philosophy the universe must take this abstract form; the defect lies elsewhere—in constructing the universe out of conceptions which are not the rational equivalents of perceptions. Every reader who has attentively followed the exposition I have given of the process by which rational equivalents are obtained will seize my meaning. Let me, however, illustrate it once more. By rigorous reasoning the principles of Imaginary Geometry prove that two parallel lines would finally meet, and that a line produced would return upon itself. But this Geometry has no methods by which to prove that such lines exist, or that a space of constant curvature is sensible in our Cosmos; and in the absence of such proof we naturally rely on the Geometry which assures us that parallel lines do not and cannot meet in our Cosmos. Were the deductions of Hegel equally

* HEGEL, *Geschichte der Philos.*, i. 37.

rigorous, his Method would still be wholly incompetent to prove that they represented the real order of phenomena, as their rational equivalents, in the same sense that true conceptions represent perceptions in their real order.

There was a superstition once prevalent that if a sorcerer constructed a waxen image of any man, all the operations he performed on that image would be simultaneously effected on the man; so that pricking a pin in the waxen breast was equivalent to planting a dagger in the man's. It is an analogous superstition that operations performed on thoughts are equivalent to operations performed on things, and that we have only to look inwards to see the process that goes on outwards. The analogy may be carried further. The operation performed on the waxen image does *represent* what would be the result of a similar operation performed on the man, but to what extent? only to the extent in which the image and the man are equivalent—*i.e.*, wherein both are material forms destroyed by the agents. But in all other respects—in those wherein they differ as waxen substance and living organism — the parallelism fails. Thus the logical operations on conceptions may represent similar operations on perceptions—the interpretation of an ideal construction is a valid interpretation of the external order, in so far, and only in so far, as the one can be taken for the rational equivalent of the other. But this is precisely the domain of Verification.

Starting from the admission that Philosophy is ideal construction formed out of symbols which represent, or are intended to represent, the real order in Feeling, and can only be true when these symbols are the equivalents of their significates, we must reject Hegel's Method, which proceeds on a reversal of this relation between Thought and Feeling, and declares Thought to be prior in nature, though posterior in time—preceding Feeling, as the abstract precedes the concrete. Analysis having once reached the abstract, and *seen* it everywhere throughout the concretes, Hegel concludes that the abstract was before the concretes, they being simply *its* concretions, and it not being an abstraction of what is common to them. This, as I have said before, is the fallacy of erecting a result into a principle, making the end the origin.*

* "Were not the dicta of Locke and Hegel, though apparently a reversal the one of the other, after all identical? Locke says, Notions are abstractions from Sensations; while for his part Hegel says, Sensations are concretions from Notions: where at bottom is the difference? Yes, but observe, Hegel's series is the

We shall have to return to this point presently, but must here continue our survey of the two Methods in their agreements and divergencies. Lagrange admits that the principle of virtual velocities is not sufficiently evident in itself to be erected into a first principle, but urges that, nevertheless, it may be regarded as the general expression of the laws of equilibrium. Hegel would also have admitted that his principle of the dialectic process is not self-evident, but would urge that, when reached by analysis of the movement of Thought, it may be recognised as the most general expression of all logical operations, and (since Nature is but the objective aspect of Thought) of all natural processes. So far the two Methods agree. But our next step confronts an important variation. The principle of virtual velocities is seen, when expounded, to be irresistible: it is reducible to an identical proposition. The principle of the dialectic process is disputable and disputed. The former principle is but an extremely abstract expression of actual observations; and its symbols mean no more than their assigned significates, *connoting* nothing beyond what they *denote*, and never varying in their values. Can this be said of Hegel's principle? If by analysis I arrive at pure Being (*Seyn*), the blank form, or the indeterminate formlessness, which is wholly without assignable predicates beyond that asserted in the simple *is*—and if also I arrive by the same process at its correlative Non-Being, equally indeterminate—can I, *must* I, construct out of these two zeros a positive number, out of these blank Noughts a full Reality, out of these subjects without predicates a subject of many predicates? Every student of Hegel knows that his paradox—the identity of Being and Non-Being—is not the sheer absurdity it appears to Common Sense; but one must have given oneself over, bound hand and foot, to the

organic system of Thought complete—so to speak, *alive* in itself."—STIRLING, *Secret of Hegel*, 1865, i. 163. Locke's series is quite as organic as Hegel's; and Mr Stirling has indicated, in a subsequent passage, where the important difference lies, namely, "that Thought never could have been acquired without previous sensuous experience. Yes, but what matters that? We do not wish it to be subjective Thought; it is objective Thought: it is Thought really *out there*, if you will, in that incrustation that is named the world. It, this world, and all outer objects, are but sensuous congeries, sensuous incrustations of these thoughts. Did a human subject not exist, it is conceivable that this congeries and incrustation would still exist, and it would exist still as a congeries and incrustation of objective Thought." This transporting of Thought out of the organism into the External Order—this transfiguration of Existence into a gigantic Ego, a thinking universe, which is man "writ large"—is the very fallacy arising from converting resultants into principles.

master, before Hegel's deduction can be reconciled with the conclusions of a Method which operates on symbols interpretable in terms of Feeling. Thus, although Being and Non-Being may be correlatives, yet if they are symbols having no qualitative values, neither their antithesis nor their union will by any operation on them bring in qualities. "Their difference, when the two are steadily looked at in thought, is seen," according to Mr Stirling, "to generate a species of movement in which they alternately mutually interchange their own identity. Being, looked at isolatedly, vanishes of its own accord, and disappears into its opposite; while Nothing, again, similarly looked at, refuses to remain Nothing, and transforms itself into Being." * All this seems coherent so long as we refrain from affixing definite significations to the terms; but fix these meanings, and then see what results. The two correlatives are of course opposites, and as such have a difference of aspect; this difference generates a species of movement—a generation truly miraculous, and therefore unintelligible—in which the moving abstractions do not simply pass from one position to another, as in all other species of movement, but each throws its nature aside to take up that of its opposite. It may be so—in the world of Notion constructed out of Hegelian symbols. It has no resemblance to any world constructed out of symbols which condense sensible experiences. When two shadows which have no solidity blend together, they make a deeper shade; they do not make a solid. If to this it be objected that there is no contradiction of opposition between two shadows, so that their coming together should generate a different result, I will ask whether a positive and a negative will yield a new positive by their union? If $o + o = o$, does not $o + 1 = 1$?

So long as Being and Non-Being are symbols without assigned values, they stand as two sides of an equation of zeros: Being, as zero, and Non-Being as zero. But no sooner do we interpret the symbols than we find one is the abstract of all existences, an expression which condenses all that is known or knowable of things; whereas the other is not the equivalent of this at all, but, instead of condensing experiences of things, is an abstract expression of their negation. Hegel admits that they are pure abstractions, which are only actual in the Becoming (*Werden*); but what I have never been able to learn is how these unrealities acquire reality, how these abstractions acquire Quality, by their mutual

* *Op. cit.* i. 49, 50.

opposition and interpenetration. The Becoming, as a mere movement of the one abstraction into the other by the dialectic process, can only be the blending of blank forms. We can understand how, starting from Feeling, or its correlative Quality, we analytically reach the two abstractions which *as* such have let drop any aspects of Quality; for this is but the familiar process by which, starting from a solid, given in Feeling, we reach the abstractions extension without solidity and surface without depth; and on these abstractions we operate; but we do not suppose that the solid was originally constructed out of these abstractions; nor that the true philosophical conception of genesis is that which presupposes things to have been thus evolved.

Hegel's principle therefore is, to say the very least, eminently disputable. But were it indisputable, the validity of his Method would have to be displayed by its success; and that success must necessarily depend upon the precision and fixity of the symbols operated on. Lagrange confines his principle to the explanation of movement and equilibrium. Dealing throughout with Magnitudes only, he invokes the axioms of Magnitude—that equals are equal, unequals unequal, and that two quantities equal to a third are equal to each other. The physical, chemical, biological, psychological relations of things are not touched; how far these may be ranged under his rubric does not concern him; he deals with the statical and dynamical relations only. Had Hegel confined himself to logical relations among symbols, and explained how the categories of Thought arise, and how they symbolise the generalities of things when perceptions are condensed in conceptions, his procedure would have been analogous to that of Lagrange. But his ambition is higher, and his Method has a wider range. He classifies both the logical and the real Universe under one rubric. An attentive study of the *Mécanique Analytique* shows that the various conditions of movement and equilibrium—all the equations of motion there adopted—are not exhibited as deductive discoveries from the principle of virtual velocities, but are merely ranged under that rubric now they are discovered. In spite of the clearness of his insight and the rigour of his deductions, Lagrange on several occasions falls into the error which haunts Deduction as its evil genius—namely, that of rendering his conclusions too absolute, by extension to cases not identical with the premises.* How much

* See the corrections of POINSOT and others in the edition published by BERTARND, Paris, 1863.

more restriction Hegel's statements require to make their abstract expressions harmonise with concrete experiences need not here be specified: the steadfast rejection of his generalisations by all men of science in their several departments may not be considered enough by his disciples; but the point on which the surest reliance may be placed is this, that Deduction is in its nature inferential, and therefore always liable to error, always needing verification.

When Hegel is contented to accept the ascertained truths of research, as Lagrange accepts the equations of motion, when his views are but the systematic co-ordination of Experience, we can have nothing further to demand than that his classification shall justify itself by the facilities it affords. It is an ideal construction; and our only attitude towards it should be one of inquiry whether it can assist us in further search. Does it so far harmonise with our experiences as to guide our thoughts and actions towards a fuller knowledge and a completer adjustment to the external order? This is a question each student must answer for himself. I answer by a decided negative; and I think I see the grounds which render Hegel's Method a failure. The Method is but an elaboration of the attempt made by Descartes and Spinoza to apply the Deduction, proved to be so successful in Mathematics, to Physics and Metaphysics. Now, although I have endeavoured to show that the Method really pursued in Mathematics is the only true procedure, I have shown that all attempts to imitate it in application to Physics and Metaphysics have been failures because the imitation has mistaken the Method which is actually pursued in Mathematics, and has pursued a Method which would equally have issued in disastrous failure there—I mean the disregard of sensible Intuition, and of step-by-step Verification. Pure Deduction is helpless in Mathematics as elsewhere. To reach new geometrical truths more is required than axioms and definitions; there must also be intuition of the figures. To reach new physical and metaphysical truths, more is needed than general laws and deductive applications; there must also be new sensible experiences. When we have the new intuitions, we can reflectively see them to be exemplifications of the axioms; and when we have the new experiences, we can class them beside the old experiences. But the procedure is not reversible. We can see what others see; we can reflect back on what was seen before; we can divine nothing. It may be possible some day to reduce all known truths to a general truth; it will never be

possible to reach a *new* and *distinct* truth without a new and distinct experience of relations; it will never be possible to reach the Unknown simply by inspection of the Known, without going through the sensible experiences in which all knowledge arises.

This is the empirical standpoint. It is, of course, disputed by metempiricists. Fichte, Schelling, and Hegel were notoriously of a quite different way of thinking. They hoped to replace the empirical procedure by an *à priori* construction. According to Schelling, Philosophy must be regarded in the light of a continuous history of Self-consciousness, for which Experience only furnishes the documents, all the forms of the Ego being represented in Nature, so that it is indifferent whether we refer to the subject or the object. What would Lagrange have said to a mathematician who regarded Dynamics in this light? The fundamental position of this school is that the logical order is the real order; which in a certain sense may be interpreted on experiential principles—namely, that the relations among symbols and the groupings of these relations *represent* the relations and groupings of feelings, which feelings are real presentations, so that ideal constructions formed out of real elements symbolically represent the real world; but *this* interpretation would be rejected with scorn by Schelling and Hegel. The meaning they intend to convey is, that Thought is identical and coextensive with Being, and the order in thoughts is the only truth of things. "Those who know nothing of philosophy," says Hegel, "throw up their arms in wild astonishment when they hear the proposition *Thought is Being*. Nevertheless the assumption of this unity is the ground of all our action;"* and Schelling scornfully sets aside the popular notion that Thought gradually conforms itself to Things; reversing it, he declares that Nature only expresses and realises the laws of Thought, and indeed *is* only Nature in so far as this is effected. "Nature is visible Mind, and Mind is invisible Nature."† The reader who has present to him the detailed exposition I have attempted of Nature as reflected in Sense and Thought (Problem III. chap. i.), will seize at once the confusion between symbols and reals which Schelling here exemplifies. He has not, like Hegel, given a systematic statement of the psychological grounds on which he bases his conclusion, but he allows us to see in glimpses the course of his thought. Thus he finds in every

* HEGEL: *Encyklopädie: Philos. des Geistes*, § 465, p. 354.
† SCHELLING: *Ideen zu einer philos. der Natur*, 1803, p. 64.

organism a necessary reciprocal relation between the parts and the whole, the parts only existing in and for the whole; but this whole is a Notion (*Begriff*), *because* wherever there is a necessary reciprocal relation between the parts and the whole there is a Notion.* The subjective nature of this unity Schelling indicates in a subsequent passage: "This unity is a Notion, and only exists in relation to an intuitively reflecting Mind" (p. 45). At the same time he declares all *necessary* Notions to be objective, and hence the conclusion that the Notion lies at the basis of the objective, as it lies at the basis of the subjective universe. Nature, in fact, is but a development of the Notion; and Mind is but a development of the Notion. Hegel has expanded and systematised this view. On it I remark that, if the term Notion be stripped of all the concrete experiences it abstractly condenses, and be reduced to its merely formal significance as the expression of the subordination of parts to a whole, we may indeed say that it is identical with every other formal expression of such subordination; and the empty symbol will then stand equally well for our conception of an organism, and for the objective organic connexus; and in the same way, this organic connexus, as a group, will be equivalent to any inorganic connexus as an object. But restore the particulars which give this Notion life, assign the values which alone can make the symbol valid, and we see at once the formalism of this identity, we see that the Notion is not simply reciprocity of relations but a reciprocity of relations in a *sensitive* sphere, having feelings and thoughts for its elements; whereas the Organism is not this, but the very different reciprocity of relations in a *vital* sphere, having tissues and functions for its elements; and the Object is still more widely separated as a reciprocity in the *physical* sphere, having masses and forces for its elements. If it shocks all Logic to say the cow is the same as a cabbage because both may be classed under the general head of an Organism, not less must it shock all but transcendental Logic to say that the processes of Nature are the same as the laws of Thought because both may be classed under the head of Grouping. And it is characteristic of Hegel that, having by an absurdly mistaken etymology, derived *Urtheil*—Judgment—from *ur-theilen* (primitive separation), he regards the enclosing of the potential parts of a plant in its development from a germ as the logical oper-

* *Op. cit.* p. 43.

ation of judgment; and adds, this example serves to show how neither the Notion nor the Judgment exist in our minds only:—"The Notion dwells in the heart of things—it is that by which they are what they are."* Nothing but a sublime reliance on his Method could have kept him serious when he propounded the theory that the bud is *refuted* by the blossom, and this blossom in turn by the fruit, which proves the blossom to have been a false existence, the truth of the plant being just this fruit.† If the blossom refutes the bud, death refutes the plant; Death, therefore, must be the final Notion! Again, when speaking of Zeno's Dialectic, he remarks that the reason why Zeno illustrated it by Motion simply was that *Dialectic is itself Motion;* in other words, Motion is the Dialectic of Being. "The Thing as self-moving has its Dialectic in that, and Motion is the becoming another while preserving itself." Zeno, we are told, never doubted the fact of Motion; he only inquired into its truth; but Motion is untrue, for it is a contradiction.‡

It is Hegel's boast that he has transformed Substance into Subject,§ which is logically acceptable, if we consider attributes as predicates; but the ambiguity of the term subject, in the sense of Mind, leads him to the conclusion that the reality of things lies not in the things themselves, but in their totality, their *universals*, and these are thoughts. All speculation (and nothing else is philosophically to be counted) is the transformation of sensuous opinion into abstract thought;|| which is true enough, but requires fuller specification, both as to how the transformation is effected, and what elements are let drop in the process of feelings being replaced by symbols. When I take the lion as a symbol of kingliness, or a bank-note as a symbol of houses, cattle, corn, &c., I shall be led into sad mistakes if I disregard their symbolical nature, and proceed to draw conclusions respecting kings from qualities observed in lions. "The specific facts of feeling, perception, desire, will, &c., in so far as they are *known*, may on the whole be called Presentation (*Vorstellung*), and we may say in general that Philosophy

* *Encyklopädie*, § 166.
† *Phänomenologie*, p. 4.
‡ *Geschichte der Phil.* i. 313.
§ *Phänomenologie, Vorrede*, p. 14.
|| *Gesch. der Philos.* ii. 223, and elsewhere, "Philosophy does nothing but transform perceptions into thoughts."—*Encyklopädie*, § 20.

puts Thoughts, Categories—more accurately Notions—in the place of Presentations;"* in other words, replaces images of things by generalised symbols of these images. "Presentations in general may be regarded as the *metaphors* of Thoughts and Notions. But to have these Presentations is by no means to know their significance for Thought, nor their Thoughts and Notions. Conversely it is one thing to have Thoughts and Notions, another to know what Presentations, Intuitions, and Feelings correspond with them."

This view of feelings, as the metaphors of Thought, is cardinal, and, I think, a fallacy. It belongs to his position of Thought being the objective truth of Things, their universals, so that Feeling is only one of its manifestations. He remarks that one of the great obscurities in Philosophy is that ordinary minds always want an image to interpret a thought. "They say, 'We don't know what to think,' when a Notion is presented them; but there is nothing more to think in a Notion than just the Notion itself." There is nothing more to be felt in a feeling than just the feeling itself; but in a symbol there is always something more to be understood than the symbol itself — namely, the significates. Hegel's view of Thought, it may be said, is so completely the reverse of mine, that I have no right to criticise him from my point of view. If my criticism were directed against the logical coherence of his deductions, this objection would be valid; but I am here attempting to show why his System is a failure, and why his Method cannot lead to an extension of knowledge; and surely, if his psychological foundation is so completely the reversal of all observation as to make Thought the *prius*, and universals the only reals, we need not wonder if we find it difficult to accept a system which, as he somewhere says, produces the feeling of walking on our hands. Because acrobats succeed in walking on their hands, and because Hegel succeeds in presenting an inverted image of the universe, this is no reason why we should give up the more effective method of Nature, and cease walking on our feet.

In his *Phänomenologie* and in his *Philosophie des Geistes*, Hegel expounds the evolution of Thought through its successive grades of Sensation, Perception, and Conception. There are several propositions which positive Psychology will recognise as its own, notably

* *Encyklop.* § 3.

that accentuated proposition—"The whole of Reason—the whole material of the Spirit—is in Sensation (*Empfindung*);"* and again, that which rejects the common view of Intellect, as a *tabula rasa*, receiving all its contents from without. But the positive psychologist must be on his guard, and not interpret Hegel's symbols without remembering the Hegelian meanings. All through the exposition runs the fallacy already noted, which makes that which is the *final result* of evolution its *initial principle* and *persistent regulator;* so that the abstract Thought which is found at the end is assumed to have generated the whole process from the beginning. This is the fallacy of an Astronomy expounding that it is the solar *system* which condenses nebulæ into suns and planets, not the nebulæ which differentiate into a solar system—of a Biology making organs and tissues the products of a differentiated Organism—of a Sociology making the aggregations and consequent polities of families, tribes, and nations the realisation of an abstract idea—the State. Hegel thus completely reverses the historical genesis. "What the Mind seems to receive from without is simply that which is rational—*i.e.*, that which is identical with itself, immanent in itself; the only purpose of the Mind is to get rid of the supposed externality (*sich selber-äusserlichseyns*) of the rational object. Thus, whatever is thought, is; and that which is, only is in so far as it is thought."† "The laws of Nature are determined by the indwelling Understanding, and hence intelligent consciousness finds in Nature its own nature reflected, and thus becomes objective to itself."‡

Pythagoras, when he argues that Number is the origin and reality of things, seems incomprehensible and absurd to many who find it quite easy and rational to accept νοῦς, or Intellect, as the Architect of the Universe. These latter ought to welcome Hegel's principle that Thought is the beginning and the end of things—the circle in which the end is presupposed, yet only *is* when the circle is complete.§ To the positive psychologist, who has been wont to trace the evolution of Thought, and who finds it to be a process of Grouping—according to one view of it; or, according to another and more special interpretation, a reproduction of experiences under symbolical forms—Hegel's principle will seem quite as irrational as

* *Philos. des Geistes*, iii. § 447.
† *Op. cit.* iii. § 465.
‡ *Op. cit.* § 422.
§ *Phänomenologie*, p. 15.

that of Pythagoras. Hegel's procedure is uniformly that of translating experiences into symbols, and then accepting these symbols as the primary and only valid reals. Quoting the Aristotelian aphorism, "Nihil est in intellectu quod non fuerit in sensu," he says that when speculative philosophy rejected this aphorism it was a mistake. We must, however, equally assert "*Nihil est in sensu quod non fuerit in intellectu.* And this means that νοῦς, or Spirit, is the cause of the world." *

The reader who is prepared to accept Thought as Thought which *thinks itself*, no less than *Things*—an infinite universality, of which Feeling, Perception, Intuition, Understanding, are the finite particulars or grades, and of which Things and Laws of Things are but the objective aspects—may find in this system a fascinating coherence. He may also accept the "plain truths" which, to Hegel's surprise, excited so great an outcry even from philosophers: "Whatever is rational, is actual; and whatever is actual is rational." Any reader indisposed to accept the identity of Thought and Being would see in the first of these "plain truths" the very questionable assertion, that "whatever is active is ratiocinative;" nor would this be effected by Hegel's explanation that from his meaning of actuality all contingency is eliminated, and only *necessary* actions are true, are active. I am not here proposing to criticise this system, only to indicate its spirit and Method. That spirit and that Method are profoundly opposed to the spirit and Method of positive Science, and it is on this ground that the system is judged. He professes indeed to found his philosophy on Experience. But his views of what constitutes Experience, and, above all, his failure to discriminate between the respective provinces of Feeling and Symbolism, lead him to conclusions which Science peremptorily rejects. In the principle of Experience, he says, "lies the unspeakably important truth that in order to accept and believe any fact we must be in contact with it; or, in more

* *Encyklop.* § 8.

That I am not misrepresenting the procedure will be apparent to any one who studies Hegel; and may be seen also in the luminous and penetrative Prolegomena which Mr WALLACE has prefixed to his translation of *The Logic of Hegel, Translated from the Encyclopædia of the Sciences*, Oxford, 1874. Perhaps this single sentence from Hegel himself will suffice: "The real contents of our consciousness are preserved, and even for the first time put in their proper light, when they are translated into the form of thought and the notion of reason."—§ 5.

exact terms, that we must find the fact united and combined with the certainty of ourselves. We must be in contact with our subject-matter, whether it be by means of our external senses, or, what is better, by our profounder mind and our innermost self-consciousness." Philosophy "takes its departure from Experience, including under that name our immediate consciousness and the processes of inference from it. Awakened by this stimulus, *Thought* is itself characterised, by *raising itself* above the *natural state of Mind*, above the senses and inferences from the senses."* Now, if Thought here means the symbols, and the natural state the feelings symbolised, I, for one, have no objection to urge against this passage except its misleading metaphors. What I object to is, that Hegel having got his symbol, relies on *it*, and all that can be got out of it, without reference to the feelings originally symbolised. He sarcastically asks, "Would any one who wished for fruit reject cherries, pears, and grapes, on the ground that they were cherries, pears, and grapes, and not fruit?" This same question may be asked of him: "Will you reject sensations, images, perceptions, on the ground that they are not thought? and will you accept whatever is true of thought in the abstract as true of any particular sensation, image, or perception?"

It might seem unfair to test Hegel's Method by his application of it to the phenomena of Nature, because his warmest disciples are ready to admit its failure there, although, if his principles are correct, they ought there to find a perfect application. Nor will I touch on his Psychology, because that science is at present in too unsettled a state for general agreement. I will simply refer to his History of Philosophy, justly regarded as one of his most considerable achievements. Because, on reviewing the various stages through which Speculation has passed, he finds that he can rearrange all opinions under his logical rubric, he insists that this was the necessary order of their evolution—in spite of the historical fact that this order was not followed. One idea is supposed to develop itself by means of its opposition to a second, and thence into a third. Whereas History very plainly shows that this was not the process at all, but that each idea, each system of thought, was developed—as everything else is—out of and by means of its own conditions; and each when evolved took its place beside the

* *Encyklopädie*, § 12.

others. Philosophy did not start with general scientific truths, and from these gradually descend to particular truths—did not even start with the fundamental truths of Motion, from thence to deduce the equations of Motion. It reached these general truths in a roundabout laborious way; but these truths, once reached, were seen to have been all along *implied* in the experiences from which they were extracted. Thus seen, they presented that Necessity and Universality so dear to metaphysicians.

Hegel recognises three paths on which Truth may be sought. The first is Experience—which is, however, a mere form, and depends upon the Sense which brings it. The second is Reflection, in which Truth is defined through its thought-relations. But in neither of these is perfect Truth to be found. That is only to be found in the pure form of Thought. Here man's attitude is one of perfect Freedom.* My answer to this is, that when the pure form of Thought shall have proved its competence by finding the Truth, and gaining the assent of rational minds to the conclusions thus found, there will be justification enough for the Hegelian Method—and not till then. For the present I am content with the fact that his Method is not the Method of Search which has heretofore discovered such truths as we have. At the best it is but a Method of codification, and its merits must be estimated by its success in codifying the results reached by Science. According to the explicit and implied testimony of all scientific workers, it has *not* hitherto justified itself in this way; and I cannot but express my regret to see that, now Germany has so emphatically pronounced its verdict by neglect, England is, in an increasing body of distinguished men, manifesting a more intelligent and sympathetic attitude towards this illusory system. In Germany the dissatisfaction with Hegel has led to a wide-spread expression of the necessity of going back to Kant. This is very significant of the futility of the metaphysical Methods. What would a biologist or chemist of our day think of the analogous proposition to give up all the results of research since Bichat and Lavoisier, and return to those teachers as guides? And why would such a proposition at once be seen to be absurd? It is because the positive Method—unlike metaphysical Methods—has its principles of rectification in itself. Experiments which are offered as proofs have to be experimentally tested, so that any error

* *Encyklopädie*, § 24.

which may unawares have crept in is seized on and thrown out. How far this is from the case of metaphysics I need not specify. Hegel's constant complaint against Kant and Schelling is that their conclusions are not *deduced;* and his own mistake lies precisely in this, that he accepts a deduction as if it were a verification. He relies on his logical abstractions as the ancients relied on their oracles, which were worded so generally as to include any particular result; and although the particular result might seem to verify the truth of the oracle, it usually did so in quite a different sense from that in which, before the event, it was interpreted.

C.

ACTION AT A DISTANCE.

In spite of Newton's emphatic disclaimer, his opponents in old days, and many of his followers in our own, have been unable to banish the idea that the relation between bodies called Attraction is a mysterious something *inherent* in Matter, seated among the molecules, so to speak, and stretching forth its grasp to bind them into masses, and distant masses into systems. I do not pretend that this is what any one avows. I only say that it is a paraphrase of what many teach. Few doubt that there is a special Agent symbolised in the term attractive force—("Ce monstre métaphysique si cher à une partie des philosophes modernes, si odieux à l'autre," says Maupertuis)—and that this Agent acts across empty space.

"That gravity should be innate, inherent, and essential to matter," writes Newton to Bentley, "so that one body may act upon another at a distance through a *vacuum*, and without the mediation of anything else by and through which this action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it." Nevertheless even his own editor, Roger Cotes, declares action at a distance to be one of the primary properties of matter; and many mathematicians and metaphysicians have flouted the scholastic axiom, "A body cannot act where it is not," treating it as a vulgar error. They urge that astronomical

phenomena prove bodies to act at enormous distances; and, moreover, that the molecules are never in actual contact even when they act on each other.

The notion of action at a distance contradicts RULE II. It presupposes a body to be moving through the space in which it does not move, existing where it does not exist. Action is dynamic existence. The force or pressure *by* which, *in* which a body acts, is *ideally*, but not *really*, separable from the active matter, and the co-existent positions named space. Having thus ideally separated the Agency from the Agent, men find it easy to suppose the Force acting where the Matter is not; and some men materialise this Force, convert it into an Ether interposed between masses and molecules, so that the Matter acts on this ethereal Force, and the Force transmits the action to Matter.

Experience does indeed seem to suggest action at a distance, and thus to contradict the axiom. I am seated in my study, and can certainly act upon any servant, who is distant from me in the kitchen. I have only to touch the bell, and she comes up-stairs. She is drawn towards me, as the apple is drawn towards the earth, across a distant space. But the scholastic axiom, "A thing cannot act where it is not," is undisturbed by such a fact, and only seems contradicted by it when we suppress in thought all the intermediate agents whose agency was indispensable. I acted directly on the bell-rope, which was continuous with the bell, and set it vibrating; the vibrations of the bell acted on the air, the air on my servant's auditory organ, that on her intellectual organ, and that in turn upon her muscles. In the fall of an apple the case seems different, because we cannot so readily realise to ourselves all the co-operant conditions; but the phrase by which we express these, when we say the earth attracts the apple, is not less elliptical than the phrase, "I caused my servant to come up-stairs by ringing the bell."

If bodies "attract" each other across empty space, we can only understand this attraction as a moving towards each other in the line of a resultant pressure, not as the dragging by immaterial grappling irons thrown from one to the other. "Equidem existimo gravitatem," says Copernicus, "non aliud esse quam appetentiam quandam naturalem, partibus inditam a divina providentia opificis universorum."* And Euler says, "In attempting to dive into the

* COPERNICUS: *De revolutionibus orbium*, I. c. ix.

mysteries of Nature, it is of importance to know if the heavenly bodies act upon each other by impulsion or by attraction; if a certain subtile, invisible matter impels them toward each other, or if they are endowed with a secret occult quality by which they are mutually attracted. Those who hold the second view maintain that the quality of mutual attraction is proper to all bodies; that it is as natural to them as magnitude. Had there been but two bodies in the universe, however remote from each other, they would have had from the first a tendency towards each other, by means of which they would in time have approached and united." *

This fiction respecting two bodies alone in the universe, and their inherent tendency to approach each other, is in open defiance of all experience.† Let us grant the existence of only two bodies isolated in space: we must first declare that, according to all the inductions from experience, they would not tend to move towards each other, for they would not move at all; some external motion or pressure would be requisite, since their own internal motions would be in equilibrium; nor would an external force impel them to move towards each other, unless the direction of that force were in this line and no other. Suppose each body to be in motion, each would pursue its own direction, nor would they ever meet, unless some third body in motion redirected them. Of course, if the bodies are assumed to have an *inherent tendency* to rush together like two water-drops, but without the external pressures which blend the water-drops, they would inevitably meet; but what evidence is there for such an assumption?

It is obvious that we cannot explain the phenomena of attraction by the fiction of two isolated bodies in empty space, because that fiction presupposes conditions wholly unlike those of the known universe, which is not an universe of two isolated bodies, but of infinite and variously-related bodies.

Mr Mill is very contemptuous in his notice of Hamilton's reliance on the axiom that one body cannot act directly on another without contact. "In one sense of the word," Mr Mill says, "a thing *is* wherever its action is; *its power is there, though not its corporeal*

* EULER: *Letters to a German Princess*, i. 211.

† "Ora a tale ipotese nessun fatto porge la minima prova diretta, perchè noi non possiamo osservare l'azione di due sole molecole e nemmeno osservare fatti analoghi ad essa nel vuote."—SECCHI: *L'unità delle Forze Fisiche*, Roma, 1864, p. 450.

presence—[a singular distinction in the writings of so positive a thinker !] But to say that a thing can only act where its power is, would be the idlest of mere identical propositions. [An axiom *is* an identical proposition.] And where is the warrant for asserting that a thing cannot act when it is not locally contiguous to the thing it acts upon? . . . . What is the meaning of contiguity? According to the best physical knowledge we possess, things are never actually contiguous. What we term contact between particles, only means that they are in the degree of proximity at which their mutual repulsions are in equilibrium with their attractions. [Are not these repulsions and attractions hypothetic phrases to express the fact that, however closely bodies may be pressed together, their molecules cannot be both made to occupy the same space, each unit, as an unit, having its limit?—a fact also expressed by *impenetrability*.*] If so, instead of never, things always, act on one another at some, though it may be a very small, distance. The belief that a thing can only act where it is, is a common case of inseparable, though not ultimately indissoluble, association. It is an unconscious generalisation, of the roughest possible description, from the most familiar cases of the mutual action of bodies superficially considered. The temporary difficulty felt in apprehending any action of body upon body unlike what people were accustomed to, created a natural prejudice which was long a serious impediment to the reception of the Newtonian theory; but it was hoped that the final triumph of that theory had extinguished it—[Newton, as we have seen, would have repudiated this conclusion]—that all educated persons were now aware that action at a distance is intrinsically quite as credible as action in contact, and that there is no reason, apart from specific experience, to regard the one as in any respect less probable than the other." †

The idea that a body like the sun, which is ninety-two millions of miles distant from us, can act *directly* on us across this distance, assumed to be a vacuum, is absolutely inconceivable, since action involves motion, and the motion through this space must be either

* "Il paraîtra par nos méditations," say LEIBNITZ, "que la substance créée ne reçoit pas d'une autre substance créée la puissance même d'agir, mais seulement une limitation et détermination de son propre effet pré-existant et de la vertu active."

† MILL: *Examination of Sir W. Hamilton*, p. 531.

the motion of the body itself, or of some body to which it has been transferred. A mere crack in a glass extinguishes its sounding property, that is to say, the waves of molecular motion are no longer propagated because of this solution of continuity; and if between us and the sun there were any solution of material continuity, the waves of ether would not reach us from the molecular agitations of the sun; or—if we suppose them to pass across this gap—it would still be the actual presence of the wave which at each point exerted its pressure. Action at a distance, unless understood in the sense of action through unspecified intermediates, is both logically and physically absurd. Logically, since action involves reaction, and is only conceivable as the combination of forces; physically, since the Attraction said to act across the distance is avowedly a *function* of the distance, which increases as the distance decreases; and this implies that the distance is an Agent. Now if we assume the space between two bodies to be empty, we make this Nothing an effective Agent, which offers resistance to pressure, and causes a decrease of attraction. I therefore ask, with Professor Clerk Maxwell, "If something is transmitted from one particle to another at a distance, what is its condition after it has left the one particle and before it has reached the other? If this something is the potential energy of the two particles, how are we to conceive this energy as existing in a point of space coinciding neither with the one particle nor the other. In fact, whenever energy is transmitted from one body to another in time, there must be a medium or substance in which the energy exists," * otherwise there would be energy which was not the active state of matter, but an activity floating through the Nothing.

It should be observed, and the observation is suggestive in many directions, that some of the most eminent physicists have not only adopted the idea of action at a distance, but have constructed on it elaborate and effective theories of electrical action. Gauss, Weber, Riemann, Neumann, and others, have interpreted electro-magnetic actions on this assumption; and the success which has attended their efforts is another among the many examples of the truth we have previously enforced, that no amount of agreement between observed phenomena and an hypothesis is sufficient to prove the truth of the hypothesis. Contrasted with the labours of these mathematicians and physicists, we have the labours of Faraday, Thom-

* Clerk Maxwell: *Electricity and Magnetism*, ii. 437.

son, Tait, Clerk Maxwell, and others, who start from the hypothesis of a material medium. Not only are they able to explain all the observed phenomena on this hypothesis, but they have the immense advantage of not invoking an agency which is without a warrant in experience. Where the mathematicians admitted only the abstraction pure Distance, and centres of force acting on each other across this Distance, Faraday and his followers have admitted with the Distance its concrete Medium, and with the centres of force, radii or lines of force; where the one class sees the abstract power of action at a distance impressed upon the electric fluids, the other class sees the actions going on in the medium, and these are the concrete phenomena. The superiority of the second point of view seems to me to consist in its speculative and its practical advantages. Although the two are mathematically equivalent, the second has the speculative superiority of conformity with Experience; and according to Professor Maxwell it has the further practical advantage of leading us to inquire into the nature of the action in each part of the medium.*

The conception of a Plenum is simply the unavoidable conclusion from the conception of Existence as continuous; and this continuity is itself the correlative of the impossibility of accepting the pure Nothing otherwise than as a generalisation of our negative experiences. But if continuity of Existence is thus necessarily postulated, it does not interfere with the utmost variety in the modes of Existence; and with every variation in mode there is superficial discontinuity. When a feeling changes, it is because another feeling has replaced it. My hand passing over a surface has one mode of feeling until it reaches the boundary, and then a new mode arises to replace the former—the feeling of solid resistance gives place to one of fluid or aerial resistance. The new mode is unlike the old, discontinuous with it; but it is nevertheless only a new form of the fundamental continuity of Feeling.

The conception of a Plenum is further shown to be unavoidable when we come to inquire into the nature of that Void which is supposed to exist in the interstices of molecules and in the interplanetary spaces. Space is the abstract of co-existent positions; its concretes are bodies in the various relations of position; but in our abstraction we let drop the bodies, and retain only the relations

* See his *Electricity and Magnetism*, vol. i. pp. 58, 65, and p. 123.

of position; although a moment's consideration suffices to show that were there no bodies there could be no positions of bodies, consequently no relations of co-existent positions—in a word, no space. If, therefore, by interspaces between molecules or planets, we understand simply the relations of position of these bodies, we may indeed conveniently abstract these relations from their related terms, and treat of spaces irrespective of bodies; but we may not from this artifice conclude that between these related terms there is a solution of the continuity of Existence,—that between the bodies there is a Void.

It is held that, were our senses sufficiently magnified, we might see the molecules and atoms distributed throughout what now appears a mass, much as we see the constellations distributed among the vast spaces of the heavens. Perhaps; but even then our magnified senses would discover no solution in the great continuum. Necessarily so, since by no possible exaltation of an organ of sense could the Supra-sensible be reached. The Void—if it exist—cannot be felt, and the only Existence knowable by us is the Felt.

Hence the idea of action at a distance is absurd, if the distance be taken to represent any solution in the material continuity, which is the continuity of the Agent whose Agency is the action; but the idea is intelligible and true if the distance be taken to represent simply the relative positions of the body from which the action is supposed to originate, and the body in which it is completed.

THE END.

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